

SCIENCE DATA PLAN
FOR THE
EOS DATA AND INFORMATION SYSTEM
COVERING
EOSDIS VERSION 0 AND BEYOND

DOCUMENT VERSION 3
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EDITORS
MATHEW SCHWALLER
BRIAN KRUPP

Reviewed by:

Gregory Hunolt
DAAC Manager
Earth Science Data and Information System
GSFC Code 505

Date

Reviewed by:

Stephen Wharton
Project Scientist
EOS Data and Information System
GSFC Code 900

Date

Approved by:

John Dalton
Project Manager
Earth Science Data and Information System
GSFC Code 505

Date

Appreciation for their significant contributions to this document is extended to
Lyn McNutt and Tom George at ASF; Sam Thompson at CIESIN; Lyndon Olsen and Brian Bailey at EDC;
George Serafino at GSFC; Donald Collins at JPL; Jim Frenzer and Bob Seals at LaRC; Michael Goodman and
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1.0 Introduction

This Science Data Plan (SDP) describes the management approach, data holdings, and projected data holdings of the Earth Observing System (EOS) Data and Information System (EOSDIS). The SDP was previously released in May 1992 and June 1993; the current version covers the time frame through Fiscal Year 1998, the year in which the first EOS spacecraft, EOS AM-1, is scheduled for launch. At that time, EOSDIS Version 1 will be fully operational.

This document is primarily an incremental update of the 1993 SDP. The 1994 version continues descriptions of EOSDIS data archiving plans and provides a “snapshot” view of the current holdings at EOSDIS Distributed Active Archive Centers (DAACs) as of July 1994 and projects holdings of the DAACs for September 1998. This version of the SDP also revises and expands previous SDP information on levels of service and priorities assigned to the data sets at the DAACs (see Appendix A). It should be noted that the SDP is intended to be a “living document” and will be updated and expanded approximately once a year.

Although the current version of the SDP is mostly an update of the 1993 Plan, the following elements are new for 1994:

- The data set holdings and data plans for the Oak Ridge National Laboratory (ORNL) DAAC and the Socioeconomic Data and Applications Center (SEDAC) are now fully described in the text and in Appendix A.
- Data holdings and services described in the text and Appendix A tables are now projected forward to 1998, the year in which EOS AM-1 is scheduled for launch.
- The Appendix A tables of DAAC holdings have been substantially revised. The tables are now split into three sections: current DAAC holdings; anticipated data holdings for data sets that have funding identified for processing, archive, and/or distribution (e.g., EOS AM-1 data sets); and anticipated data holdings for which such funding has not yet been identified.

Copies of this or a previous year’s SDP can be obtained through the points of contact listed in the table below.

TEXT COPIES	ELECTRONIC COPIES
EOS Library Code 505 Goddard Space Flight Center Greenbelt, MD 20771 Attn.: Librarian (301) 286-5641	This report is available via file transfer protocol (ftp) on the public server eos.nasa.gov under the path: EosDis/Daacs/Docs/ScienceDataPlan The text is in MS Word RTF format, the Appendix A tables are in Excel SYLK format. Use 'anonymous' for the user id, use your email address for the password.

Table 1.1 Points of Contact for Copies of the Science Data Plan

1.1 Scope

This document covers the following topics:

- Data policy, including data availability, data pricing, and billing procedures—Section 2.1.
- The plan for archiving data at the EOSDIS DAACs—Section 2.2.
- Plans for the migration of data sets from one DAAC to another or from a non-DAAC data center to a DAAC—Section 2.3.
- Pathfinder data set plans—Section 2.4.
- A summary of expected non-EOS data sources, including the NASA Earth Probe data (e.g., UARS, SeaWiFS, TOMS) and international satellite data (e.g., ERS, JERS)—Sections 2.5 and 2.6.
- The plan for data availability at the affiliated data centers of the National Oceanic and Atmospheric Administration (NOAA) and the International Earth Observing System (IEOS)—Section 2.7.
- The status of the current Earth observation data holdings (through July 1994) at the DAACs—Section 3.
- DAAC data holdings projected to July 1994—Section 4.
- Inventory summaries of the current and anticipated DAAC data holdings, including information needed for data management (e.g., data set categorization by funding method, action required, type of user requiring the data, and priority level)—Appendix A.
- The data sets listed in Appendix A mapped to the U.S. Global Change Research Program science priorities—Appendix B.

1.2 Background

NASA's Mission to Planet Earth is a Presidential initiative to understand the interactive physical, biological, and social processes that regulate the total Earth system. Mission to Planet Earth includes EOS, a series of Earth Probe missions, NASA's Earth Science Research and Analysis program, and EOSDIS. As such, EOSDIS is seen as a cornerstone of Mission to Planet Earth, serving as the mechanism for generating, archiving, and distributing useful data products to a worldwide alliance of users. More details on all aspects of Mission to Planet Earth can be found in the current version of the *EOS Reference Handbook*.

A major role for EOSDIS is to provide archive and distribution services for NASA's Earth science data and related data from other sources. Thus, EOSDIS data sources include current holdings of existing data centers, new products to be generated from existing data sets, data from current and future Earth Probe satellite missions, remote sensing data generated by International Partner missions, data from the EOS instruments on the EOS and International Partner satellites, and data from ground-based

studies by NASA and other organizations. EOSDIS data holdings projected through July 1998 are presented in Appendix A.

EOSDIS provides other services in addition to archiving and distributing Earth science data. EOSDIS will generate user-defined products for all EOS instruments and will facilitate the combination and manipulation of data from all sources as well as their incorporation into models of the environment. Through EOSDIS, users will also have access to data held by agencies associated with IEOS and to the data systems of other agencies associated with the U.S. Global Change Research Program. (Again, see the *EOS Reference Handbook* for details.)

EOSDIS, as currently configured, consists of nine Distributed Active Archive Centers. These were selected based on their existing institutional Earth science discipline and research expertise, infrastructure, and commitment. DAACs are located at four NASA centers: the Goddard Space Flight Center (GSFC), the Jet Propulsion Laboratory (JPL), the Langley Research Center (LaRC), and the Marshall Space Flight Center (MSFC). DAACs are also located at five non-NASA data centers: the Alaska SAR Facility (ASF) at the University of Alaska Fairbanks, the U.S. Geological Survey (USGS) EROS Data Center (EDC), the National Snow and Ice Data Center (NSIDC) at the University of Colorado, the Department of Energy (DOE) Oak Ridge National Laboratory (ORNL), and the Socioeconomic Data and Applications Center (SEDAC) at the Consortium for International Earth Science Information Network (CIESIN). For more information, contact any DAAC User Services Office (Table 1.2).

User needs for EOSDIS will become more clearly understood as researchers work with and respond to early versions of the system; undoubtedly, user needs will change over time. New information systems technology will emerge continually, including new data base and information management technology applicable to Earth science data, faster processors, and more capable networks. To succeed over its lifetime, EOSDIS must respond to change; its design and the implementation process must foster change while supporting ongoing operations and user services. Development and prototyping will continue throughout the life of the system.

The EOSDIS design will promote openness to change by incorporating layering, standards, and vendor independence to the fullest extent possible. A prototyping program will permit new features, functions, and implementations of new technology to be tested and evaluated in a near-operational setting, with successful prototypes implemented in the operational EOSDIS. EOSDIS evolution begins with V0, and will continue with subsequent versions as described below.

EOSDIS V0—A working prototype with some operational elements. This system interconnects existing Earth science data systems via electronic networks, interoperable catalogs, and common data distribution procedures to provide better access to existing and pre-EOS data. Starting with existing, heterogeneous Earth science data systems, V0 will evolve toward the full EOSDIS by taking maximum advantage of existing experience and by ensuring that no disruption in current user

Facility	Phone, Internet, and URL Addresses
ASF DAAC	(907) 474-7869 asf@eos.nasa.gov usa@santa.asf.alaska.edu
CIESIN SEDAC	(517) 797-2727 ciesin@eos.nasa.gov ciesin.info@ciesin.org http://www.ciesin.org
EDC DAAC	(605) 594-6116 edc@eos.nasa.gov glis@glis.cr.usgs.gov
GSFC DAAC	(301) 286-3209 gsfc@eos.nasa.gov http://sun1.cr.usgs.gov/landdaac/landdaac.html
JPL DAAC	(818) 354-8980 jpl@eos.nasa.gov podaac@shrimp.jpl.nasa.gov
LaRC DAAC	(804) 864-8656 larc@eos.nasa.gov userserv@eosdis.larc.nasa.gov http://eosdis.larc.nasa.gov
MSFC DAAC	(205) 544-6329 msfc@eos.nasa.gov msfcuser@microwave.msfc.nasa.gov http://wwwdaac.msfc.nasa.gov
NSIDC DAAC	(303) 492-6199 nsidc@eos.nasa.gov nsidc@kryos.colorado.edu
ORNL DAAC	(615) 241-3952 ornl@eos.nasa.gov ornldaac@ornl.gov

Table 1.2 DAAC User Services Points of Contact

services occurs. Through the interconnection of the existing systems, V0 will serve as a functional prototype of selected key EOSDIS services. As a prototype, it will not have all the capabilities, fault tolerance, or reliability of later versions; however, EOSDIS V0 will support use by the scientific community in day-to-day research activities. Such use will test existing services to determine the additional or alternative capabilities required of the full EOSDIS. Development began in 1991; V0 became operational as a limited release in July 1994, becoming fully operational soon thereafter.

An effort parallel to the Version 0 development is the generation of new global change data products from existing satellite data. The Pathfinder effort will generate new products using community consensus algorithms. These data will be archived and distributed by the DAACs and data centers of other participating agencies. A discussion of Pathfinder data is contained in Section 2.4.

Subsequent EOSDIS Releases will supplement capacity and services as required by EOS spacecraft launches. EOSDIS capabilities will evolve based on continuing evaluation by the research community, and technology will be enhanced as the need arises.

1.3 Revising the SDP

The SDP is revised approximately once per year, reporting present DAAC holdings and services and projecting holdings and services into the future. The descriptive information and data set characterization in the Appendix A tables will be updated as necessary.

The SDP will be submitted to the DAAC User Working Groups, DAAC Project Managers and Project Scientists, and EOS Project and Program Scientists for review and recommendations.

2.0 Data Plan

This section is an overview of the plans for Earth science data management in the EOSDIS DAACs and in the other data centers, both U.S. and international, that are affiliated with EOSDIS. Some of the initial holdings of the DAACs will migrate from existing institutional facilities (see Section 2.3). Additional data sets will be generated as part of the Pathfinder activities (see Section 2.4) and by the several Earth Probe projects (see Section 2.5). Field measurement data collected by research programs or as ground-truth data for satellite missions will be archived. Some international mission data will also be supported by the V0 DAACs (see Section 2.6).

When EOSDIS V1 is operational, data supported by the DAACs will come from seven primary sources.

- The Science Data Production System (SDPS) components of the EOSDIS DAACs that will be the source of EOS data products.
- Data that have migrated from the V0 system to V1.
- Cooperative missions with International Partners.
- A continuing series of Earth Probe missions.
- Foreign satellite missions.
- Continuing Pathfinder product-generation activities.
- Ground-based field campaigns.

Additional data sets will be obtained from various U.S. and international data centers, which will provide operational data for use in generating EOS data products.

The following sections consider data policy, allocation of science data to the DAACs, data migration, Pathfinder data, Earth Probes data, and international mission data. Data archival schedules are presented for new DAAC data sets, DAAC data migration, and future data sets.

2.1 Data Policy

EOS data policy is designed to be consistent with the U.S. National Data Policy and to further EOS objectives of acquiring a comprehensive global, long-term data set, maximizing data utility for scientific purposes, and simplifying access to and analysis of EOS data. A common set of data exchange principles will cover the Japanese, European, and U.S. missions that constitute IEOS.

Four general categories of users are expected to access EOS data: research users, including U.S. Government-sponsored and other researchers; noncommercial operational- and environmental-monitoring public-sector agency users; applications demonstrations; and others. The last category includes commercial and educational users.

Research Users—These users will be designated through an Announcement of Opportunity or similar mechanism, based on a brief proposal describing their research activity. Designated research users, whether funded by the EOS Program or through other channels, must sign a “research agreement” and are granted access to the data appropriate for their proposed research from EOS and its foreign partner programs at no more than the marginal cost of filling the specific user request. The research agreement includes a brief description of the proposed research and confirms that the data are to be used in a study or investigation that aims to establish facts or principles. The following conditions will apply:

- The data may not be sold, and may only be reproduced or provided to others who are covered by a research agreement and for whom the researcher takes responsibility.
- Research results will be submitted for publication in the scientific literature.
- Detailed results, including data, algorithms, and models, will be made available to the research community at the time they are accepted for publication.

Public-Sector Agency Users—Operational and environmental monitoring involves noncommercial routine use of data to carry out a mandate of environmental observation and prediction as part of an agency’s responsibilities to provide for the general welfare. Such users include those Government agencies that conduct environmental monitoring and operational observations, and can include larger agencies to which the parties belong, such as the World Meteorological Organization (WMO). Operational agencies may obtain real-time access through their own direct readout facilities and via relay satellites or as available from the appropriate data and information systems. Operational users may be asked to report periodically on their activities.

Applications Demonstrations—Users who fall into this category are involved in limited proof-of-concept studies to demonstrate new techniques or to test the feasibility of operational applications. Results of applications demonstrations must be published as technical reports and provided to the data system that supplied the data. Data requests for applications demonstrations must include a brief proposal describing the intended use. Selected users will be required to sign an agreement confirming that the data will be used only for the proposed applications demonstration, will not be used for commercial purposes, and will not be reproduced or provided to third parties without permission.

Commercial Users—Commercial agreements will be established for each sensor or data set to serve users who do not fit into one of the above categories. Procedures will be in place prior to EOS launch for commercial distribution of all EOS data on a nondiscriminatory basis for “other” users.

The data exchange principles described above will be included in each bilateral Memorandum of Understanding (MOU) that NASA will have with its international partners. A joint implementation plan is being developed to define the implementation of these principles by the participating agencies. Each of the international partners may waive some or all of the restrictions on redistribution of data for which it is responsible.

At this time, each DAAC has its own policy and procedures that cover data availability and pricing. The following sections provide an overview of data availability and pricing policies. Requests for

specific information on current DAAC policies should be addressed to the User Services Office at the DAAC in question (see Table 1.2).

2.1.1 V0 Data Availability

In general, all data sets archived in the DAACs will be available to all users on a nondiscriminatory basis in a timely manner.

There are several V0 data sets for which there will be exceptions to this policy. These exceptions are due to the following considerations:

- Data originating from a commercial organization.
- Data originating from U.S. or international agencies, with distribution restrictions.

An example is Sea-Viewing Wide Field of View Sensor (SeaWiFS) data, for which users must obtain prior authorization from the SeaWiFS Project. All data sets with distribution restrictions are indicated clearly in Appendix A. Specific conditions and restrictions on those data sets are discussed in Sections 3 and 4.

2.1.2 Pricing Policy

NASA Headquarters will establish uniform data pricing guidelines that will be applied to all EOSDIS holdings. Pricing of EOS data will be in accordance with the IEOS Data Exchange Principles, which provides that data will be available to all agencies at no more than the marginal cost of filling the specific user orders for requests covering research use, applications use, and noncommercial operational use for public benefit. It is NASA's intent to drive marginal cost as low as possible by using innovative design and new technologies—such as network delivery—whenever possible. DAAC data will also be available to each IEOS agency user for other uses in accordance with the terms and conditions to be established by the data-providing agency for the individual data sets. These prices are to be applied uniformly to all users of the respective data sets. In conformance with the IEOS Data Exchange Principles, this data pricing policy will also apply to U.S. users of other IEOS agency data.

Currently, the individual DAACs have their own data pricing policies on charging for data. In all cases, the charges are no more than the marginal cost of filling the orders. Details on the applicable charges by a specific DAAC can be obtained by contacting the appropriate User Services Office.

ASF—Standard digital data and photographic products will be provided at the nominal cost of reproduction. ERS-1 and JERS-1 data are available only to authorized users. Custom photographic products are supported with charges calculated on a time-and-materials basis. Further information, including how to become an ERS-1 or JERS-1 authorized user, can be obtained by contacting the ASF User Services Office.

EDC—The prices for data products available from the EDC DAAC vary but do not exceed the marginal cost of filling user orders. For some products, such as those maintained on-line for network access, there are no user charges involved. For other products, depending on the data set and distribution media involved, the charge to users may include the media and shipping costs, the cost of tape copies, or the cost of extracting data from archive media and processing and reformatting for distribution. Pricing information can be obtained by contacting the EDC User Services Office.

GSFC—At present, the Goddard DAAC provides all data at no cost to the user. The Goddard DAAC expects to have a formal pricing policy in place in 1995.

JPL—At present, the data distributed by the JPL DAAC are distributed at no cost to the user as a service to the scientific community. In the future, JPL will adopt a pricing policy as directed by Earth Science Data Information System (ESDIS) and NASA Headquarters.

LaRC—The current LaRC DAAC policy is:

- For orders of modest size, the use of electronic transfer of data will be encouraged, which will be free to the user.
- For data requests exceeding a volume acceptable for electronic transfer, data will be provided on standard media or CD-ROM for specific data sets. These will be free to the user.
- For single requests requiring large media deliveries, or for repetitive single requests constituting large aggregate orders, the user will be required to supply replacement media or acceptable substitute media. This will be negotiated between the DAAC User Services Office and the user prior to filling the order.

MSFC—At present, the Marshall DAAC distributes data at no cost to the user. The Marshall DAAC maintains a pricing policy consistent with the guidelines issued by ESDIS and NASA Headquarters.

NSIDC—The Special Sensor Microwave/Imager (SSM/I) and Scanning Multichannel Microwave Radiometer (SMMR) data on CD-ROM's were funded by NASA and are distributed at no cost to the user. All other NSIDC distributions generally follow the NOAA pricing policy of recovering cost when charging users for data products. The costs associated with each product request are determined by the type and quantity of media required to fill the order, the amount of labor involved to process the order, and the cost of shipping the product. Product requests requiring special processing are handled on a per-request basis. The cost of the resources expended to satisfy a customer order constitute the charges that are passed on to the user. Additional information can be obtained from the NSIDC User Services Office.

ORNL—The Oak Ridge DAAC will, whenever possible, distribute data free to the user. If it becomes necessary to charge for data, charges will be in accordance with the EOS Pricing Policy.

SEDAC—The SEDAC supports the policy that data should be provided at the lowest possible cost to global change researchers in the interest of full and open access to data. It is possible that some

member agencies in CIESIN's Information Cooperative may have a pricing policy that deviates from the above. The policies of these independent agencies will be honored.

2.1.3 Interagency and International Cooperation

EOS development activities are being coordinated with several U.S. agencies through the U.S. Global Change Research Program (USGCRP) and with international partners through the Earth Observations–International Coordination Working Group (EO–ICWG). National Space Policy Directive 7 cemented U.S. interagency relationships by establishing the Space-Based Global Change Observation System (S–GCOS) program in June 1992. In tandem with other studies coordinated through USGCRP, S–GCOS will provide the global observations that help researchers understand Earth as a system. The U.S. Government has placed S–GCOS in the forefront of USGCRP to ensure the collection of comprehensive, integrated sets of consistent ground- and space-based observations; the space component of S–GCOS has Mission to Planet Earth as its centerpiece.

NASA is participating in the development of the Global Change Data and Information System (GCDIS). GCDIS will serve to link the data systems (e.g., NASA's EOSDIS) of the U.S. agencies participating in USGCRP. GCDIS will be the primary mechanism for the exchange of data and information among the participants in USGCRP.

Domestic interagency cooperation in developing and implementing EOS is ongoing, especially among those agencies with space programs or significant responsibilities for archiving Earth science data. EOS and NASA's Mission to Planet Earth program were planned to benefit from and complement the capabilities of their Federal partners. These partners are:

- Department of Commerce/National Oceanic and Atmospheric Administration (DOC/NOAA).
- Department of Defense (DoD).
- Department of Energy (DOE).
- Department of the Interior/U.S. Geological Survey (DOI/USGS).

Additional information on the global change activities of these agencies can be obtained from the *EOS Reference Handbook*.

NOAA will support the Earth science user community by making data accessible from its data centers that archive and distribute Earth science data. Several data centers will be involved in this arrangement, each archiving different Earth science discipline data obtained from satellite and terrestrial instrumentation. Each data set covers a different time span and geographic area, ranging from local to global regions. Catalogs are available that list the archived data. As of July 1994, EOSDIS V0 will be electronically interoperable with NOAA's Satellite Active Archive (SAA). The SAA User Assistance Office may be contacted for additional information [phone (301) 763–8400, fax (301) 763–8443, email saainfo@nesdis.noaa.gov].

NOAA will also support EOSDIS data product generation and EOS science requirements by providing, in near-real time, meteorological data sets necessary for these applications. These data sets will be archived in an appropriate EOSDIS DAAC or at a NOAA DAAC.

The EO-ICWG is the forum within which the U.S., Europe, Japan, and Canada discuss, plan, and negotiate the international cooperation essential for implementation of the International Earth Observing System in the 1990's and beyond. The international partners include Europe (ESA, EUMETSAT), Canada (CSA), and Japan [the Science and Technology Agency, the National Space Development Agency (NASDA), and the Ministry of International Trade and Industry (MITI)]. Additional information on the contributions to be made by these international partners can be obtained from the *EOS Reference Handbook*.

International research investigators for the EOS mission were selected by NASA through the EOS Announcement of Opportunity. Principal Investigators for Interdisciplinary Science Investigations were chosen from Australia, Brazil, and Canada. Co-Investigators for the science investigations and EOS instrument team members represent 10 countries. These international EOS investigators are funded by their respective national agencies, but will have full access to observations acquired by EOS and other services made available through EOSDIS.

2.1.4 Landsat

This section presents the current data policy and status of Landsat data and the changes underway as a result of recent congressional action.

EOSAT will continue to distribute Landsat-4 and Landsat-5 Thematic Mapper (TM) and Enhanced Thematic Mapper (ETM) data for which it has exclusive marketing rights under its contract with the Department of Commerce. EOSAT retains the rights to these data for 10 years after acquisition. After 10 years, the data rights and archive responsibilities will revert to USGS and the EROS Data Center. EDC will distribute these data without restriction and at nominal cost.

EDC has copies of all TM CCT products generated by EOSAT through 1989. Recently, EOSAT reduced the price of these data, consisting of approximately 8,000 processed scenes in LTWG-quad format on 6250 bpi 9-track tapes. Most of the scenes were acquired by Landsat-4 and -5 between 1985 and 1989. While EOSAT retains the rights to these data, EDC will take over the function of filling customer orders at a cost of about one third that normally charged by EOSAT. EDC will not perform any data processing; orders will be filled only by copying tapes.

The data rights and distribution and archive functions for all Multi-Spectral Scanner (MSS) data were returned to USGS/EDC, effective February 23, 1993. EDC has copies of all MSS data acquired by either EOSAT or USGS.

MSS data are not currently (since January 1993) being acquired by either USGS or EOSAT, and there are no plans to resume this activity. Approximately 2,000 scenes acquired by EOSAT between October 1992 and January 1993 have not been processed. EDC has copies of these data but cannot currently

process these scenes. Hence, these data are available in raw form only. EDC does have plans to acquire the hardware and software necessary to process these data within approximately 2 years.

With the passage of the Land Remote-Sensing Policy Act of 1992 (PL 102–555), responsibility for Landsat program management was assigned to Landsat Program Management (LPM), designated in PL 102–555 as the NASA Administrator and the Secretary of Defense, but changed through directive from the National Science and Technology Council (No. 1, May 5, 1994), to NASA, NOAA, and USGS. The law stipulates that Landsat Program Management will:

- Develop a management plan.
- Devise and conduct a Landsat advisory process.
- Procure Landsat–7.
- Conduct a technology demonstration program.
- Develop alternative approaches to continue land remote sensing into the next century.

A management plan defining the roles, responsibilities, and baseline budgets for NASA, NOAA, and USGS in the Landsat program has been written and submitted to the participants for formal approval. The Landsat advisory process was initiated in 1993 and is ongoing. Procurement of Landsat–7 and the ETM+ instrument on a Martin Marietta Astro Space (MMAS) platform is underway.

The specifics of the technology demonstration program are yet to be determined. In the NASA/DoD program, this requirement was filled by the High Resolution Multispectral Stereo Imager (HRMSI) instrument. The elimination of HRMSI as a result of Landsat program restructuring left space on the platform for a flight opportunity for another instrument. The nature of this instrument is undefined, but the purpose of the flight opportunity is to test new technology for land remote sensing. Because of a severely constrained budget in the restructured Landsat program, the flight opportunity instrument will have to be built, integrated with the spacecraft, and operated at the expense of the sponsor.

Development of new approaches to land remote sensing started last year under DoD auspices. Although DoD will not be an active participant in LPM after FY94, its sponsorship of the “Advanced Land Remote Sensing System” (ALRSS) is likely to continue. NASA researchers, through the Landsat Project Office at GSFC, are participating in the ALRSS effort and, if that effort continues to the planned conclusion, expect to draw upon its results to fulfill the requirement of the law.

PL 102–555 also requires LPM to assume responsibility for Landsat–4/5 operations from NOAA. However, with the recent change in the membership of the LPM, NOAA will retain the contractual responsibility to oversee system operations.

The Landsat Program will affect global change research as follows:

- The spatial and spectral characteristics of TM and ETM+ data are not duplicated by any other system currently acquiring data or anticipated for launch before the end of the decade. These data bridge the gap between data from very high-resolution sensors and data from low-resolution/broad-area sensors (e.g., AVHRR and MODIS). Landsat data serve a unique role in

global change research by allowing researchers to scale up results of previous studies, conducted in limited areas, to regional and global scales. In addition, Landsat data provide a means to measure change on a scale responsive to short-term human activity and to monitor change before the impact is widespread and mitigation is harder and more costly to implement.

- The Landsat-7 data policy will ensure that data are readily available by reducing the cost of the data to all users, foreign and domestic, to the marginal cost of fulfilling user requests, and by lifting all restrictions on duplication of unenhanced data.
- For the period prior to the launch of Landsat-7, LPM has negotiated an agreement with EOSAT that lowers substantially the cost of TM data for U.S. Government and affiliated users, educational institutions, and nonprofit organizations. The agreement also removes, on an established schedule, all restrictions on duplication of data purchased by those users for noncommercial purposes. Both elements of the agreement should increase the availability and impact of Landsat TM data on global change research.
- Full integration of the Landsat ground system with EOSDIS will ensure further that both the science and nonscience user communities of Landsat data have full access to the archival data and to the process to obtain new acquisitions.
- The Landsat-7 ground system will make more unenhanced Landsat data available to the user community—and make it available more quickly—than at any previous time. The improvements in Landsat data acquisitions, archiving, and distribution will enhance the role of these data in global change research.

It is expected that the EDC DAAC will act as the agent for LPM to process, archive, and distribute Landsat-7 data and fulfill its direct statutory responsibility as the National Satellite Land Remote Sensing Data Archive.

2.2 DAAC Data Allocation

Science data products were assigned to a particular EOSDIS data center for archiving according to the scientific discipline associated with each data set. This section describes the data allocation plan.

NASA's DAACs were selected based on their existing institutional Earth science discipline and research expertise, infrastructure, and commitment. These DAACs are located at four NASA centers: the Goddard Space Flight Center (GSFC), the Jet Propulsion Laboratory (JPL), the Langley Research Center (LaRC), and the Marshall Space Flight Center (MSFC). DAACs are also located at four non-NASA data centers: the Alaska SAR Facility (ASF) at the University of Alaska Fairbanks, the U.S. Geological Survey (USGS) EROS Data Center (EDC), the Department of Energy (DOE) Oak Ridge National Laboratory (ORNL), and the National Snow and Ice Data Center (NSIDC) at the University of Colorado. The Consortium for International Earth Science Information Network (CIESIN), headquartered in Saginaw, MI, developed the Socioeconomic Data and Applications Center (SEDAC).

Table 2.1 summarizes the discipline responsibilities, experience, and data assignments for the DAACs. The following paragraphs summarize the near-term support goals and data objectives of each facility.

ASF—The primary activity of the Alaska SAR Facility is to process, archive, and distribute Synthetic Aperture Radar (SAR) data, to support the user community, and to receive X-band direct downlink data from a variety of satellites. The SAR instruments that are currently operational are on the following satellites: European Space Agency (ESA) European Remote-Sensing Satellite (ERS-1) launched in July 1991 and the Japanese Earth Resource Satellite (JERS-1) launched in February 1992. Additional data will be obtained from the Canadian Radarsat, ESA ERS-2, Japanese ADEOS, and various other elements of IEOS.

ASF supports research on the characterization of the effects of global change in polar regions, and the relationship of these changes to the global climate system. ASF promotes interdisciplinary and multisensor studies using SAR data. It also supports users by developing and hosting new research tools and scientific algorithms, by preparing new scientific data products, and by providing near-real-time support to scientific field campaigns. The satellite data sets supported by the ASF DAAC include existing collections of AVHRR, Landsat, and SAR. Other data sets include derived products, such as ice motion and classification products and wave products. New products are currently in the alpha stage of development, and are being considered for limited distribution to the research community. ASF also provides mission planning support for all international SAR missions.

EDC—The Land Processes DAAC at EDC supports global change research on conditions and processes existing and operating at or near the land surface, especially as they relate to biology, geology, hydrology, limnology, and ecology. EDC supports studies of conditions and processes affecting land-atmosphere and land-ocean interactions, and attempts to model the role and influence of these processes and interactions in the history and evolution of the total Earth system. The Land Processes DAAC seeks to promote the interdisciplinary study and understanding of the integrated Earth system. Researchers are supported by improving the access to relevant data and data products, and in the application of those data and data products to interdisciplinary Earth science and global change studies.

Data Center	Experience	Discipline Responsibility	Data Assignments
ASF	Alaska SAR Facility	SAR Imagery, Polar Processes	ERS-1, JERS-1, ERS-2, Radarsat, and ongoing role as ground station
EDC	Landsat, AVHRR, GLIS	Land Process Imagery	ASTER, AVHRR, Landsat, MODIS (land), SAR (land), and airborne sensors
GSFC	UARS, CZCS, AVHRR, Atmospheric Sounding, Tropospheric Moisture, Remote Sensing of Atmospheric Temperature and Moisture, <i>NCDS & PLDS data systems</i>	Upper Atmosphere, Atmospheric Dynamics, Global Biosphere, Geophysics	CZCS, SeaWiFS, TOMS, UARS, AVHRR Pathfinder, TOVS Pathfinder, 4-D Assim, TOGA-COARE (V0 data sets), AIRS/AMSU/MHS, GLAS, HIRDLS, MIMR, MLS, MODIS, SAGE III, and TRMM (VIS)
JPL	AVHRR, Seasat, SSM/I, SMMR, TOPEX/Poseidon	Physical Oceanography, Air-Sea Interactions	AVHRR Oceans, EOS-ALT, MIMR, NSCAT, Seasat, SeaWinds, SSM/I, SMMR, and TOPEX/Poseidon
LaRC	ERBE, SAM II, SAGE, SRB, MAPS, GTE, FIRE	Radiation Budget, Clouds, Aerosols, Tropospheric Chemistry	ACRIM, ASTER, CERES, EOSP, ERBE, MOPITT, MISR, SAGE III, SOLSTICE II, and TES
MSFC	SSM/I, WetNet, Passive Microwave Remote Sensing	Global Hydrologic Cycle	MIMR, TRMM (TMI, PR, LIS), SSM/I, SSM/T2, MSU, and SMMR
NSIDC	SMMR, SSM/I, In situ Snow and Ice Data, CDMS	Cryosphere and Polar Processes (non-SAR), Cryosphere/Climate Interactions	DORIS, GLAS, MIMR, SSALT, SSM/I, and TMR (MODIS and ASTER snow and ice products proposed)
ORNL	CDIAC, ARM, WDC for Trace Gases	Biogeochemical Dynamics, Trace Gas Fluxes, Terrestrial/Aquatic/Marine Ecosystem Field Experiments	In situ trace gas and gas flux data, BOREAS, OTTER, FIFE, and PLDS data, field campaign data, selected CDIAC data sets
SEDAC		Policy Making Applications	Socioeconomic data

Table 2.1 EOSDIS-Sponsored Data Centers

GSFC—The objective of the Goddard DAAC is to archive and distribute science data and provide support services to research scientists in the discipline areas of upper atmospheric chemistry, atmospheric dynamics, and global biosphere. The Goddard DAAC supports data sets from several previous Earth science data systems that served as precursors to the DAAC. An ongoing activity involves the migration of many of these data sets from these precursor archives to other DAACs or data archive sites. Additional data sets generated by current and future flight projects (e.g., UARS and

SeaWiFS) will be archived and distributed along with several newly reprocessed data sets, including, for example, the AVHRR Land and TOVS Pathfinders and the 15-year record of version 7.0 Nimbus-7 TOMS ozone data. Beginning in FY95, the Goddard DAAC will assume responsibility for the operational processing of the TOVS and AVHRR Land Pathfinder data sets.

JPL—The goal of the JPL DAAC is to serve the needs of the oceanographic, geophysical, and interdisciplinary science communities that require physical information about oceans and air-sea interactions. This goal will be accomplished through the acquisition, processing, archiving, and distribution of data obtained through remote sensing or conventional means and through the provision of higher level data products to the scientific community. Key data sets currently available include those from the TOPEX/Poseidon mission and the AVHRR Oceans Pathfinder Project. Looking ahead, the JPL DAAC is preparing for the archive and distribution of data from the NSCAT and SeaWinds instruments on the Japanese ADEOS and ADEOS follow-on spacecraft, respectively. The DAAC will also continue to participate in the development of EOSDIS, and will provide data services related to conventional and remotely sensed observations of the ocean and atmosphere.

LaRC—The Langley DAAC focuses on the discipline areas of radiation budget, clouds, aerosols, and tropospheric chemistry. It provides data management, archival, and distribution functions for the general science community in these areas and processing for specific data sets. The development of the Langley DAAC draws on resident scientific expertise and institutional capabilities involved in space flight missions and major field campaigns related to Earth radiation budget and atmospheric chemistry. The overall goals of the Langley DAAC are to enhance access to and use of existing data sets in its discipline areas. Furthermore, the DAAC is preparing for the product generation, archive and distribution of data from the following EOS instruments: Clouds and Earth's Radiant Energy system (CERES), Earth Observing Scanning Polarimeter (EOSP), Measurement of Pollution in the Troposphere (MOPITT), Stratospheric Aerosol and Gas Experiment (SAGE) III, Active Cavity Radiometer Irradiance Monitor (ACRIM), and Tropospheric Emission Spectrometer (TES).

MSFC—MSFC has implemented the SSM/I Pathfinder and incorporated both the WetNet data system and MSU Pathfinder data sets into the DAAC. MSFC continues to process near-real-time microwave data sets (both active and passive) in support of global hydrologic cycle research. The Marshall DAAC focuses on using existing remote sensing algorithms to create atmospheric water vapor, cloud liquid water, marine wind speed, rain rate, land surface classification, land surface temperature, and tropospheric and lower stratospheric temperatures data sets. The principal satellite data sources used in these analyses are the SSM/I and the Microwave Sounding Unit (MSU). Lightning detection data sets, precipitation data sets created from National Weather Service radar, and surface rain gauge data sets are also archived at the DAAC. Additionally, the DAAC is planning and preparing to support the Tropical Rainfall Measuring Mission (TRMM) through processing and archiving the Lightning Imaging Sensor (LIS) data and archiving the TRMM Microwave Imager (TMI), the Precipitation Radar (PR), and the TRMM Ground Truth Data sets.

NSIDC—The National Snow and Ice Data Center (NSIDC) at the University of Colorado is the primary U.S. archive for snow and ice data. NSIDC operates under a charter from NOAA, National Environmental Satellite Data and Information System (NESDIS), with funding from several Federal agencies. The DAAC is one component of the NSIDC program, which is intended to serve the polar

oceans and ice research communities with data products generated primarily from polar-orbiting low-bit-rate instruments. In particular, NSIDC is responsible for processing, archiving, and distributing sea-ice parameters from passive-microwave, medium-resolution visible and infrared, atmospheric sounding, and altimetry satellite data over ice sheets.

ORNL—The Oak Ridge National Laboratory (ORNL) DAAC is responsible for handling data related to biogeochemical dynamics. This includes biological and physical processes and conditions that govern the storage and fluxes of energy, water, trace gases, carbon, nutrients, and other elements in and between ecosystems and the physical environment. The objectives of the ORNL DAAC are to acquire, process, archive, and distribute biogeochemical data generated primarily through ground-based field investigation as well as remote-sensing techniques. The ORNL DAAC archives data relating to key radiatively and chemically active gases to assess how their fluxes are affected by the oceans, the terrestrial biosphere, and the changing composition of the troposphere. The ORNL DAAC also seeks data that help explain how biogeochemical processes in various types of ecosystems contribute to the formation, dissipation, transport, and fate of trace gases and other elemental fluxes throughout the biosphere—to identify global sources and sinks of those substances. As part of its mandate as a data center, the ORNL DAAC archives biogeochemical data generated by NASA and other agencies or institutions; generates value-added products that synthesize and summarize global biogeochemical data; and supports field investigations by providing assistance in data management, quality assurance, and generation of metadata.

SEDAC—The goal of the Socioeconomic Data and Applications Center (SEDAC) is to develop policy-oriented applications products that synthesize Earth science and socioeconomic data. This applications development is intended to support the public policy analysis and policy making community. SEDAC will develop and operate a directory capability—interoperable with the Global Change Master Directory and EOSDIS—that provides the socioeconomic community with information about Earth science data products, and the Earth science community with information about socioeconomic data. To reach this end, SEDAC will archive and distribute the data directly, or will make the data available through cooperative agreements with other data providers.

2.3 DAAC Data Migration¹

In order for the DAACs to assemble the existing data sets in accordance with the data allocation plan in Section 2.2, data sets (and the concomitant archival responsibilities) will be transferred from existing institutional facilities to a DAAC, from one DAAC to another, and from other data centers to a DAAC. Planning for this data migration is in progress. The data migration schedule depends on the availability of funding and resources required to support data migration at both the old and new data centers. Significant efforts may be required at both ends. In particular, some data sets require restoration or reformatting; action is required beyond the simple movement of data. Discussions pertaining to data

¹The term data migration is often used to indicate the transfer of data from one type of storage media to another. In the SDP, this activity will be referred to as data restoration or reformatting. Data migration will be used to indicate only the movement of data from one facility to another.

migration considerations are included in Sections 3 and 4. The schedule for data migrations that are already agreed to is provided in Section 2.8.2.

The majority of data sets previously supported by Pilot Land Data System (PLDS) nodes at GSFC, JPL, and Ames Research Center (ARC) will move to the Oak Ridge or EDC DAACs. EDC will receive some aircraft data. Aircraft data generated in field campaigns will move to Oak Ridge. Oak Ridge will also archive First ISLSCP Field Experiment (FIFE) data and will support BOREAS data when available. It is expected that this transition will be completed in 1994.

The National Space Science Data Center (NSSDC) has identified Earth science data sets in its data base. The ESDIS Project, in cooperation with the DAACs, is developing a transition plan for evaluating the NSSDC holdings. The remainder of the NSSDC-supported Earth science data will be offered to NOAA and USGS or placed in the Federal Records Center permanent archive.

Several historical Nimbus-7 data sets, primarily Solar Backscatter Ultraviolet Radiometer (SBUV), Total Ozone Mapping Spectrometer (TOMS), and Limb Infrared Monitor of the Stratosphere (LIMS), will be transferred to the Goddard DAAC. LaRC will receive the Nimbus-7 data sets appropriate for radiation budget studies. Digital image data, such as those received from the Geostationary Operational Environmental Satellite (GOES) and Synchronous Meteorological Satellites (SMS-1, -2), will be sent to the EDC. Nimbus-7 SMMR data over polar regions were identified for migration to NSIDC.

Specific data set migration information can be found in the Archive columns of the Appendix A tables. The FY94 column shows the current facility where the particular data set is located, with the FY95 column indicating the DAAC that will receive the data. The actions required to handle these data sets are indicated by the code in the Data Category column A (Action) in the Appendix A tables.

2.4 Pathfinder Data

The Pathfinder data set concept was initiated by the EOS Program Office at NASA Headquarters to support global change research by providing access to large remote-sensing data sets prior to the availability of EOS data. From these long time series of global and regional data sets, higher level geophysical products will be derived to support US Global Change Research Program (USGCRP) objectives. The main goal of the Pathfinder program is to make research-quality global change data sets easily available to the science community. As scientific understanding develops and product retrieval algorithms improve, these data sets may require additional reprocessing, which would be provided by this program.

All Pathfinder data sets involve space-based observations. The raw data should be capable of a stable calibration, and when data from multiple instruments are involved, consistent intercalibration between the different instrument data should be possible. Pathfinder activities include reprocessing these data using community-consensus algorithms as recommended by designated Science Working Groups (SWG's). The resultant data sets will be available through DAACs under EOSDIS V0.

Another objective of the Pathfinder effort is to gain experience in processing, managing, and distributing massive data sets. This experience will guide the EOSDIS development activity. To achieve this, the Pathfinder program planning includes development, if necessary, of new data handling systems. These systems must efficiently handle large-volume data sets, generate higher level products, and reprocess data as required to achieve higher quality data sets.

In October 1990, NOAA and NASA signed an agreement establishing three joint NASA/NOAA Pathfinders to be generated from existing NOAA data sets, as follows:

- Advanced Very High-Resolution Radiometer (AVHRR) Global Area Coverage (GAC) data held by NOAA.
- Television Infrared Observing Satellite (TIROS) Operational Vertical Sounder (TOVS) data held jointly by NOAA and NASA.
- Geostationary Operational Environmental Satellite (GOES) data held by the University of Wisconsin under contract with NOAA.

In 1991, the SSM/I data set was added as a NASA/NOAA Pathfinder. SSM/I data are currently archived by NOAA under a Shared Processing Agreement with the Navy and the Air Force. Landsat MSS and TM data—held primarily by USGS/EDC—were added to the Pathfinder activity in 1992. The Landsat Pathfinder effort involves NASA, the Environmental Protection Agency (EPA), and USGS. Also in 1992, NASA's SMMR data set was added as the first NASA-only Pathfinder. Other existing data sets are being evaluated to determine their utility within the overall objectives of the multiagency Pathfinder program.

SWG's were formed for each identified data set to provide recommendations for specific Pathfinder activities. SWG reports to the involved partner agencies consist of the following:

- Determination of the scientific needs for Pathfinder data and how these needs translate into specific products.
- Identification of community-consensus algorithms for generating Pathfinder products and determination of the data required to generate these products.
- Recommendation on how these products are to be generated, validated, stored, and maintained.
- Identification of the data services required by users of Pathfinder data (including catalog and browse functions, metadata, and data access).

A Benchmark Period (April 1987 to November 1988) was chosen to facilitate complementary analyses and intercomparison studies. Wherever possible or applicable, Pathfinder data processing begins with this period. In pursuit of the most efficient processing method, different procedures may take place at separate facilities, requiring data transfer among them.

“Interuse” of Pathfinder products from various satellites and instruments has been the topic of study of several workshops to assess the formats, projections, resolutions, and binning of all Pathfinder data, and to determine how to resolve inconsistencies. The general conclusion of these studies is that

product standardization does make sense to a certain extent. Thus, to support global modeling, all Pathfinder teams are committed to the generation of one or more low-resolution, equal-angle products for climate assessment and model assimilation. One-half or 1-degree latitude/longitude products are being made available for this purpose. Furthermore, of the Pathfinder Science Working Groups that have decided on data distribution format, all have agreed to store and distribute the data in the Hierarchical Data Format (HDF) wherever possible. This multiobject file format allows smooth transfer of graphical and floating point data between information systems. HDF has also been chosen as the standard data format for EOSDIS.

The Pathfinder Level-1 and *reprocessed* higher level data products will be treated as new data sets. They will have a primary NASA location (copies will also be available from other participating agencies) according to the DAAC discipline responsibilities. The currently planned Pathfinder data set locations are shown in Table 2.2.

The following sections present the current status and plans for Pathfinder data sets. More detailed information will appear in subsequent versions of the SDP.

2.4.1 AVHRR GAC

AVHRR Pathfinder scientific data products will consist of global vegetation and radiance data for the land community, global sea surface temperature data for the ocean community, and global clouds, radiation, and aerosols data for the atmospheric science community. These data are generated from GAC observations made by the 5-channel AVHRR instruments on board NOAA-7, -9, and -11 and will cover the period mid-1981 through 1992 and beyond. Pathfinder processing for the Benchmark Period, however, involves processing only of NOAA-9 and -11.

The AVHRR Land Processing Team at GSFC began generating land products in May 1993. JPL began generating ocean products in May 1994. NOAA will make available the Phase 1 AVHRR Combined Atmospheric Product for the benchmark period by July 1994.

Preliminary products to be generated from the AVHRR GAC Pathfinder were defined by the SWG's as follows:

Level-1 GAC Data—GAC data will be archived by NOAA. The archive will contain the NOAA data with no corrections applied. A set of tables will be developed for use in correcting and

Instrument	Data Products	Archive
AVHRR	Level-3 Land Products	GSFC
AVHRR	Ocean Products	JPL
AVHRR	Level-3 Atmosphere Products, NOAA SAA Products	LaRC
AVHRR	Level-1B GAC, Level-3 Atmosphere, NOAA SAA Products	NOAA
TOVS	Pathfinder Atmosphere Products (Paths A, B)	GSFC
TOVS	Pathfinder Deep Layer Products (Path C)	MSFC, NOAA
TOVS	Pathfinder Polar Products (Path P)	NSIDC
GOES	Level-0 Data	Univ. of Wisc.
GOES	Cloud and Radiation Products	LaRC
SSM/I	Antenna Temperatures, Land Surface and Atmospheric Products	MSFC
SSM/I	Marine Wind Speed	JPL
SSM/I	Polar Subset, Snow and Ice Products	NSIDC
SMMR	Level-1 Data and Hydrology Products	MSFC
SMMR	Ocean Products	JPL
SMMR	Polar Subset, Snow and Ice Products	NSIDC
Landsat	Land Products	EDC

Table 2.2 DAAC Pathfinder Data Allocation

modifying these data. The corrections will be applied before generating higher level products. The AVHRR Level-1B GAC data that serve as the processing input (including new calibration tables designed to stabilize the calibration and provide inter-instrument calibration) are also a Pathfinder product. Transcription teams at NASA and NOAA copied more than 30,000 magnetic tapes to almost 400 optical disks, each holding 6 GB of data. This effort was completed at the end of 1992. These data will be used to generate higher level products. NOAA will store and support these data on optical disk.

Atmosphere Products—A Level-3 data set of atmosphere products mapped to a 1-degree equal-area grid will be generated twice a day (i.e., separate day and night products) with global, daily coverage. Each data set will consist of approximately 60 parameters in each cell. The products will include cloud, atmosphere, aerosol, and radiation budget parameters along with the averaged radiances and cell location and viewing geometry.

Land Products—A daily Level-3 data set containing the daytime 5-channel radiances and supporting information will be generated at 8 km resolution. These data are then used to generate an 8–11-day (three per month) composite Level-3 data set, with plans for the addition of a climate product compositing a longer time period, perhaps 1 month, later in FY94. The daily data set includes Normalized Difference Vegetation Index (NDVI) and supporting information such as scan and solar geometry and cloud and QC flags. Also being provided is a single ancillary file containing latitude,

longitude, elevation, and a land/sea mask, all of which have been coregistered to the 8 km Goode's projection.

Ocean Products—A Level-3 data set will be generated twice a day at 9 km resolution and will contain sea surface temperature (SST) and statistics along with supporting information such as cloud masks. JPL will also assemble and archive buoy data to be used in conjunction with AVHRR Pathfinder ocean processing.

2.4.2 TOVS

A TIROS Operational Vertical Sounder (TOVS) implementation team meeting was held in June 1992. A set of geophysical parameters for specific spatial and temporal scales was selected for inclusion into the NOAA-10 Benchmark Period data set. It was also decided that the Level-3 products from the first month of the period (i.e., April 1987) would be used as a quality check using three distinct processing methodologies as recommended by the TOVS Science Working Group and involving five investigator groups: Path A at GSFC; Path B at the Laboratoire de Meteorologie Dynamique/Atmospheric Radiation Analysis Group (LMD/ARA) at Ecole Polytechnique in Paris, France; Path C1 at MSFC; Path C2 at NOAA; and, finally, Path P at the Polar Science Center of the University of Washington. The Path P technique is an extension of the Path B methodology optimized for use primarily in the polar regions north of 60 degrees. By April 1994, the remaining 19 months of Benchmark Period data will be processed by the five teams for intercomparison and validation of the results. Path A and B products will be archived and distributed by the Goddard DAAC, Path C2 by NOAA's SAA facility and C1 by the MSFC DAAC, and Path P by the NSIDC DAAC.

The Path A approach involves using the interactive physical retrieval algorithm developed by the Goddard Laboratory for Atmospheres. Path B (and the derivative Path P approach) incorporates the physical-statistical "3I" methodology involving classification techniques used for routine processing of TOVS data at the LMD/ARA. The Path C methods focus on deriving geophysical quantities (primarily temperature) representative of broad atmospheric layers and, as such, eliminate the need for the *a priori* or and/or hydrodynamic model information required by the Path A and Path B approaches.

NCAR reformatted and shipped 2 years of the Level-1B input data (March 1987 through February 1989) to the PI's of each processing path. GSFC is actively involved in the receipt, verification, duplication, and redistribution of the resultant Benchmark Period Level-3 products to the five teams for intercomparison and validation. A follow-up Implementation Team meeting convened in late May 1994 at GSFC to discuss the results of the intercomparison. As of July 1994, the entire set of Benchmark Period products is scheduled to be available from the DAACs. For the longer term, it is expected that reprocessing the full 15-year record of TOVS data will require about 3 years for the Path A and Path B methodologies and a substantially shorter time for the Path C approaches. The Goddard DAAC is currently preparing to assume the role of operational processing center for the Path A algorithm, with a scheduled start date of October 1994.

All additional Level-1B input data required for the long-term TOVS Pathfinder reprocessing will continue to be supplied by NOAA/NESDIS and, for data unavailable from NESDIS, by NCAR. The products to be generated by the TOVS Pathfinder include the following Level-3 parameters:

Paths A and B:

- Temperature at mandatory levels (Path A)
- Mean temperature between mandatory levels (Path B)
- Coarse layer mean temperatures (Path A and B)
- Specific Humidity at selected mandatory levels (Path A)
- Total precipitable water above selected levels (Path A and B)
- Surface skin temperature (Path A and B)
- Cloud fraction, cloud top temperature and pressure (Path A and B)
- Total ozone (Path A)
- Outgoing longwave radiation (Path A)
- Precipitation estimate (Path A)
- Forecast surface pressure (Path A)

Path C:

- Lower tropospheric deep layer mean temperature (Path C1)
- Lower stratospheric deep layer mean temperature (Path C1)
- Oceanic precipitation rate (Path C1)

- Tropospheric deep layer mean temperature (Path C2)
- Deep layer mean temperature in six layers (Path C2)
- MSU limb-corrected brightness temperatures (Path C2)

Path P:

- Level temperatures
- Total precipitable water
- Surface skin temperature
- Effective cloud fraction
- Cloud top temperature and pressure
- Surface microwave emissivity
- PBL stratification
- Geostrophic drag coefficient
- Wind turning angle

All Level-3 parameters will be binned to a 1-degree equal angle grid and will include both AM and PM, daily, 5-day, and monthly composites. All products have been stored in a similar HDF format for ease of intercomparison and validation.

2.4.3 GOES PATHFINDER

The GOES Pathfinder effort involves reprocessing data streams from the VAS sensor aboard GOES-7, and the Imager and Sounder instruments aboard GOES-8, and GOES-J—with reprocessing for the Benchmark Period focusing solely on GOES-7. VAS employs one visible and four infrared channels when operated in its imaging mode (VISSR), and 12 infrared channels when operated in its sounding mode (VAS). Radiance and water vapor data are sampled at 1 and 8 km for the visible and infrared imaging mode, and 7 to 14 km for the sounding mode. The temporal resolution for GOES data is 30 minutes.

At the University of Wisconsin's Space Science Engineering Center (SSEC), water vapor and infrared image data are sampled, and true averaging is applied to the visible measurements to produce an 8-km product (created from full-resolution GOES imagery at 1-hour temporal resolution). An equal-area statistical product set at ~70-km resolution also is being generated. The ~70-km statistical products are being used to investigate the cloud and radiation budget of Earth. These data and products will be used to develop algorithms for use in a second pass, which will generate validated products for general distribution. GOES Pathfinder products under development include mean radiance, standard deviation, skew, and maximum and minimum for the 8-km values within each equal-area grid.

The GOES archive contains over 115 TB of reconstructed unprocessed data dating back to 1978. These data are managed through a NOAA/National Climatic Data Center (NCDC) contract to the University of Wisconsin Madison. NCDC and LaRC will be responsible for the archive and distribution of the final products. Due to the high volume of the GOES Pathfinder products, SSEC will offer on-line access through a rotating scheme; the statistical products will also be available through LaRC.

2.4.4 SSM/I

Products from the Defense Meteorological Satellite Program (DMSP) F8 SSM/I are currently being generated for the SSM/I Pathfinder Benchmark period (August 1987 to November 1988). Current plans are to continue this time series for the period of record. Distribution of the SSM/I Pathfinder geophysical product data set is planned to begin in mid-1994. The SSM/I Pathfinder benchmark data sets are being processed at the MSFC and NSIDC DAACs. The MSFC component of the SSM/I pathfinder is focused on the swath (satellite projection) data sets, while NSIDC DAAC is processing the SSM/I data into Level 3 products using the Equal Area SSM/I Earth Grid (EASE-Grid).

The first phase of the Pathfinder at MSFC is to reformat the Remote Sensing Systems (Frank Wentz) antenna temperatures (T_a data sets) into HDF. The HDF T_a data sets include the antenna pattern correction and all other metadata necessary to convert antenna temperatures to brightness temperatures. Stored with the T_a data are the latitude and longitude arrays for each scan cycle and flags identifying erroneous and missing data. Two dual-browse images (separate ascending and descending global

composites) for the 19 GHz and 85 GHz images are included. This first phase of the MSFC SSM/I Pathfinder is complete and ready for distribution.

The second phase at MSFC is processing the SSM/I T_a data into geophysical products (Level-2). The SSM/I Pathfinder SWG recommended the algorithms for deriving the geophysical products. The recommended algorithms are the Wentz atmospheric product suite of water vapor, cloud liquid water content, and marine wind speed, the Goddard Scattering Algorithm version 2 for rain rate, the Neale et al. land surface classification, the McFarland et al. land surface temperature, and the Cavalieri et al. sea-ice concentration. As of July 1994, the entire set of Benchmark Period MSFC SSM/I Pathfinder products is available for distribution from the DAAC.

NSIDC DAAC is reprocessing SSM/I data to produce Level-3 global gridded brightness temperature, plus Level-3 output from all of the algorithms listed above except for precipitation.

2.4.5 Landsat

The goal of the Landsat/Land Cover Pathfinder effort is to establish long-term, medium- to high-resolution data sets for specific regional and global applications to global change research. The Landsat Pathfinder SWG defined a three-stream approach for using Landsat data sets to address land-cover change. A subgroup on products was also formed to consider the long-term scientific goals and requirements of the Landsat/Land-Cover Pathfinder project.

The Landsat/Land Cover Pathfinder Stream I concerns the Humid Tropical Deforestation Project, in which Landsat scenes from three epochs (1970-'s, 1985, and early 1990's) are being used to monitor the rate and extent of deforestation in the moist tropics, and to assess the fate of the deforested land. This study is important from a global change perspective, since tropical deforestation processes are estimated to produce 90 percent of the current release of biotic CO_2 , and may account for 20-30 percent of all CO_2 added to the atmosphere. Three major regions were selected for the study: the Amazon Basin, Central Africa, and Southeast Asia. A methodology has been developed wherein data are selected, land cover type (forest, deforestation, water, cloud) is determined and digitized, and the product is georectified and stitched into regional coverage at 60 m resolution. Spatial statistics will be calculated. As part of this process, approximately 3,000 Landsat scenes (~1 TB total) will be required for the complete study; acquisition of these data is underway. By Spring 1994 the project had good TM data for South America (1990's) and good MSS data for South America and Southeast Asia (1980's), with some MSS data available for Central Africa. The initial output data set will consist of digital maps of forest and deforestation; distribution formats for the data set are yet to be determined.

The Landsat/Land Cover Pathfinder Stream II represents the North American Landscape Characterization (NALC) Project, a cooperative effort between NASA, the U.S. Environmental Protection Agency (EPA), and the U.S. Geological Survey (USGS). NALC objectives are to develop standardized remotely sensed data sets and standard analysis methods in support of investigations of changes in land cover, to develop inventories of terrestrial carbon stocks, to assess carbon cycling dynamics, and to map terrestrial sources of greenhouse gas (CO , CO_2 , CH_4 , and N_2O) emissions.

The NALC project area includes the conterminous United States, Alaska, Hawaii, Mexico, Central America, and the Caribbean islands. Landsat "triplicates" from the same epochs as the Humid Tropical Deforestation Project are being acquired. These consist of MSS data from the years 1973, 1986, and 1991, plus or minus 1 year. The specific temporal windows vary for geographic regions based on the seasonal (phenological) characteristics of the vegetation cover. Selection of the triplicate scenes for analysis was completed in June 1993. By Spring 1994, 203 of 801 triplicates were available for analysis. By December 1994, data analysis should be completed for the tropical forests of Mexico. In 1995–1996 the analyses will be expanded to cover remaining portions of the conterminous U.S. Output products will consist of the Landsat images comprising the NALC triplicates and, where available, coregistered 3 arc-second DEM's. These will have systematic radiometric and geometric corrections applied, and will be precision corrected for geocoding. In addition to these NALC triplicates, selected derivative or higher level data products at 60 m resolution (land cover classifications, land cover change images, etc.) will be sent to EDC for archive and distribution.

The Landsat/Land Cover Pathfinder Stream III involves the Landsat Pathfinder Global Land Cover Test Sites Project. This project will focus on compiling and analyzing time series data sets from selected sites chosen because of historical data richness, as sites of field studies, or for other characteristics contributing to global change research or monitoring, e.g., the location of an EOS Interdisciplinary Science (IDS) research site, an EOS instrument team site, or an LTER network site. Preferred sites will be supported by local experts, and have appropriate ancillary data available, e.g. DEM's, and have an ecosystem which has global extent. Site selection and priority ranking of sites (including 41 sites in North and Central America) were completed in May 1994. The first phase of the study involves assembling Landsat MSS, Landsat TM, and 1 km AVHRR data for the selected sites, and generating a basic 8 mm tape product, which includes a site description, Landsat and AVHRR radiances for the site, DEM's, and land cover classification. A second phase will incorporate tools and utilities, and automated registration between data sets (TM, MSS, SPOT, AVHRR).

2.4.6 SMMR

The major focus of the SMMR Pathfinder activity involves determination of a consistent calibration of the SMMR Level-1B data over the life of the instrument and generation of a complete set of recalibrated SMMR brightness temperatures. Calibration drifts and errors in the original data have resulted in spatial and temporal biases in geophysical parameters derived from the SMMR observations. Most of the calibration errors can be removed based on analyses of the raw observations and engineering data contained in Nimbus-7 TAT tapes covering an 8-year period. These errors include long-term calibration drifts; unaccounted effects of orbital thermal cycling, warm-up transients, polarization mixing, and incident-angle variations; effects caused by observing the Sun in the cold-calibration horn; bias errors in brightness temperature compared to radiative transfer model calculations; and bad or missing data.

There will be two SMMR Level-1B Pathfinder products, each containing 10 channels (5 frequencies, 2 polarizations) of brightness temperature data. The first consists of recalibrated SMMR data in swath (orbital) format, with spatial resolution varying from 21 x 33 km for the 37 GHz channels to 105 x 160 km for the 6.6 GHz data. MSFC will archive the complete set of swath data, consisting of

approximately 100 GB of data. The complete data set is expected to be available by October 1994. The second Level-1B product will contain SMMR data mapped to NSIDC's 25 km EASE-grid format. This data set will be distributed by NSIDC, but its date of availability has not been set.

2.5 Earth Probes Data

NASA will continue to support Earth observing missions that are not part of the EOS program. These missions are independent flight projects collectively referred to as Earth Probes. The data products generated by the NASA Earth Probe missions will be transferred from the flight project data centers to the appropriate DAAC for archive and distribution to the general user community. A brief overview of these Earth Probe missions is provided in the following sections.

2.5.1 UARS

The Upper Atmosphere Research Satellite (UARS) mission is aimed at improving knowledge of the atmosphere above the troposphere, with a primary focus on the chemistry, dynamics, and energy balance of the stratosphere and mesosphere. The platform was successfully launched on September 15, 1991. The Improved Stratospheric and Atmospheric Sounder (ISAMS) instrument has acquired data only intermittently because of a hardware problem and is no longer being operated. The Cryogenic Limb Array Etalon Spectrometer (CLAES) instrument has exhausted the supply of cryogen and is no longer operating. All other instruments are performing nominally. The information that follows is primarily extracted from NAS report number 430-1003-001, *Upper Atmosphere Research Satellite (UARS) Mission*, prepared by C.A. Reber, May 1985. This report may be consulted for more specific information on the parameters measured by each experiment.

UARS carries nine¹ Principal Investigator (PI) experiments that provide data in three general areas.

- Energy Input

- SOLSTICE—Solar-Stellar Intercomparison Experiment

- SUSIM—Solar Ultraviolet Spectral Irradiance Monitor

- PEM—Particle Environment Monitor

- Species and Temperature

- CLAES—Cryogenic Limb Array Etalon Spectrometer

- ISAMS—Improved Stratospheric And Mesospheric Sounder

- MLS—Microwave Limb Sounder

- HALOE—Halogen Occultation Experiment

- Winds

¹The UARS platform carries a tenth instrument (ACRIM—Active Cavity Radiometer Irradiance Monitor). This instrument has used UARS as a “platform of opportunity,” and the data will be archived by the GSFC DAAC in early FY95.

HRDI—High Resolution Doppler Interferometer

WINDII—Wind Imaging Interferometer

Standard data processing is conducted by the UARS project through the UARS Central Data Handling Facility (CDHF). PI's had proprietary rights to the data from their respective instruments for 2 years after launch—i.e., until September 1993. Since that time, the Goddard DAAC has archived UARS data for distribution to the general user community. There are no distribution restrictions on these archived UARS data.

The GSFC DAAC initiated the receipt and archive of UARS data in October 1993. The priority for data to be supported by the DAAC is Level-3 first and Level-2 second, with the Level-0 and Level-1 data to follow as resources permit. Negotiations are underway between NASA and NOAA to determine the long-term, permanent archive for the UARS lower level products. By the end of CY94, the DAAC data holdings at Level-3 will be nearly current, with the only delays being the time needed to process and validate the data. It is assumed that only the most current data product versions will be supported by the DAAC. If data are reprocessed by the UARS project, the new products will replace the previous ones in accordance with the GSFC DAAC's granule replacement policy.

The UARS project will provide a single Level-2 and one or more Level-3 data sets from each instrument for archiving in the Goddard DAAC. The several Level-3 data sets are defined as follows:

- 3AL—Daily products generated from Level-2 data mapped to a standard latitude grid.
- 3AT—Daily products generated from Level-2 data mapped to a standard time grid.
- 3TP—Auxiliary parameter file for Level-3AT data.
- 3LP—Auxiliary parameter file for Level-3AL data.
- 3B—Daily data generated from Level-3AL and represented as Fourier components.
- 3AS—Daily averages of solar observations.

Table 2.3 presents a summary of the data sets to be generated and archived for each instrument and contains estimates of the data volume.

2.5.2 TOMS

The first Total Ozone Mapping Spectrometer (TOMS) was launched October 24, 1978, on the Nimbus-7 satellite and ceased to function on May 6, 1993. A slightly modified copy of this

Instrument Name	Data Volume (MB/day)						
	2	3AL	3AT	3TP	3LP	3B	3AS
SOLSTICE	20.4						0.013
SUSIM	3.0						0.015
PEM	15.8		14.5	16.9			
CLAES	0.27	6.0	8.9			31.0	
ISAMS	20.6	1.8	2.5	1.9	1.4	4.7	
MLS	0.4	1.6	2.0	0.2	0.2	11.0	
HALOE	0.01		0.6	0.2			
HRDI	1.1	0.5	0.7			19.8	
WINDII	5.1	0.2	0.3			4.8	

Table 2.3 UARS Data Sets

instrument was launched on the Russian Meteor-3 spacecraft on August 15, 1991, and is currently making daily measurements of ozone over the sunlit portion of Earth.

There are plans for additional TOMS instruments. A Russian launch of a second TOMS instrument is planned for an unspecified meteorological satellite during the late 1990's. Two TOMS will operate as dedicated Earth Probe missions, with provisional launch dates of July 1994 and the third quarter of 1997. A TOMS will be on the Japanese ADEOS platform scheduled for launch in February 1996. Beginning with NOAA-O, TOMS instruments may be included in the manifest of operational instruments on the NOAA polar orbiters. All of these instruments will be placed in Sun-synchronous polar orbits.

Three standard data sets are generated from TOMS data. A Level-1 data set contains Level-0 data and additional information such as calibration coefficients and Earth location. This corresponds to the RUT-T data originally archived in NSSDC, and the RUF data currently being generated for the Meteor-3 TOMS. The data volume is approximately 19 MB per day for each instrument. The Level-2 data set contains three parameters: Total Ozone, Surface Reflectivity, and Bidirectional Reflectance Distribution Function (BRDF) at the top of the atmosphere. This corresponds to the HDTOMS data set archived at NSSDC. The Level-2 data volume is approximately 8 MB per day per instrument. The Level-3 data set is generated by mapping the total ozone onto a standard map grid. This corresponds to the GRIDTOMS data with a volume of approximately 0.3 MB per daily map. Beginning in mid-FY94, the quasi-equal area GRIDTOMS format will be superseded by the new TOMS Daygrid equal angle format in HDF. This new format will be used for all Meteor-3 and reprocessed Nimbus-7 Level-3 TOMS data products, as well as data from future instruments. In addition, the HDTOMS product from Nimbus-7, Meteor-3, and all future instruments will be implemented in the HDF format and supported by the GSFC DAAC beginning in FY95. The RUTT data will be transcribed to a new medium by the data producer by the end of CY94, after which it will be decided whether the data will reside at the DAAC or with the producer. All of the TOMS products in the original formats will then be transitioned to the Federal Records Center (FRC).

Data from the Nimbus-7 TOMS have been processed under the direction of the Ozone Processing Team (OPT) currently managed by GSFC Code 916. The OPT will be responsible for all data processing and analysis tasks for all TOMS instruments with the exception of instruments on NOAA platforms, for which NOAA will generate standard products.

TOMS data will be archived and distributed by the Goddard DAAC. There will be no distribution restrictions. The first data to be supported by the Goddard DAAC are the Level-3 data from the Nimbus-7 and Meteor instruments, for which archiving began in the April-May 1994 time frame. After completion of the ingest and archive of all Meteor-3 backlogged data, it is anticipated that new data will be available from the DAAC on a near-real-time basis, most likely within 15 to 30 days of observation. The DAAC will support only the most recent version of all products. If data are reprocessed, the new products will replace those in the archive.

2.5.3 SeaWiFS

The Sea-Viewing Wide-Field-of-View Sensor (SeaWiFS) will make global measurements of ocean color as a successor to the Coastal Zone Color Scanner (CZCS). SeaWiFS is expected to be launched on the Seastar platform in April 1995 by the Orbital Sciences Corporation (OSC), which will sell the data to NASA. For additional information on SeaWiFS consult "An Overview of the SeaWiFS Project," by S. B. Hooker and W. E. Esias, *EOS, Trans., AGU, Vol. 79*, No. 21, p. 241, May 25, 1993, as well as the document referenced therein. The following paragraphs present the key features of the SeaWiFS instrument and introduce the data products to be generated.

Commercial and operational users will obtain data and data products directly from OSC. OSC will retain all commercial rights to SeaWiFS data for 5 years. During this period, science data will be made available only to research users with prior authorization from the SeaWiFS project. There will be a further restriction on the research data consisting of a 2-week embargo during which only the SeaWiFS Science Team members will have access to the data.

The sensor is designed to have a nadir field of view of 1.1 km, with the scan period adjusted so that successive scans provide continuous coverage at nadir. Full-resolution data will be directly broadcast through the High Resolution Picture Transmission (HRPT) system. The HRPT data will be encrypted and continuously broadcast. Authorized ground stations will be supplied with the encryption key so that they can decode and process the data. The SeaWiFS project will maintain a catalog of all received HRPT data and will be able to access the data stored at HRPT stations as required. Approximately 20 minutes per day of full-resolution data will also be recorded for playback as Local Area Coverage (LAC) data.

To achieve global coverage within the capacity of the onboard recorder, the full-resolution data will be subsampled at every fourth pixel on every fourth scan line and recorded to generate GAC data. GAC data will have resolution identical to LAC and HRPT, but the number of data points is reduced by a factor of 16.

The GAC and recorded LAC data will be downloaded to GSFC's Wallops Flight Facility (WFF) twice a day. The SeaWiFS Data Processing System will receive the data from Wallops. In addition, a GSFC HRPT station will receive direct-broadcast data that will be recorded and forwarded to the ground processing system.

The SeaWiFS project will generate several types of products, which are discussed in the referenced document. The following paragraphs consider only the data to be supported by the Goddard DAAC (i.e., all data products except the non-GSFC HRPT station data). The Goddard DAAC may also act as a single point of contact to allow authorized users to obtain data not held by the DAAC.

While a formal agreement between the SeaWiFS project and EOSDIS is not final, the working assumptions are as follows: the SeaWiFS project will be responsible for all data processing and reprocessing; the Goddard DAAC will receive data (Levels 1–3, browse and metadata, and catalog information) and a list of authorized users from the SeaWiFS project; the Goddard DAAC will archive the data products and supporting information; and data will be distributed only to authorized users; other potential users will be referred to the SeaWiFS project or OSC.

At this time, the Goddard DAAC is expected to archive and distribute the SeaWiFS data sets as summarized in Table 2.4 (volumes represent uncompressed data.) It is assumed that only the most current version of the products are contained in and supported by the DAAC archive. This implies that as data are reprocessed by the SeaWiFS project, the new products will replace those previously stored in the DAAC.

Data Product	Volume* (GB/yr.)
GAC—L1	112
GSFC HRPT—L1 (4 U.S. coastal stations)	425
Recorded LAC—L1	57
GAC—L2	168
GAC—L3, Compressed	142
GAC—L3, Mosaic	15
Browse Products	0.1
Ancillary Data	TBD
Total	919
*Volume estimates are for data products generated at launch (uncompressed)	

Table 2.4 SeaWiFS Data Sets—Goddard DAAC

2.5.4 TOPEX/Poseidon

TOPEX/Poseidon¹ is a joint U.S. (NASA) French (Centre National d'Etudes Spatiales—CNES) mission intended to make accurate measurements of sea level over a 3–5 year period. The satellite was launched on August 10, 1992, on an Ariane launch vehicle from French Guyana. A summary of the TOPEX/Poseidon mission and its data products is provided below.

This mission features two radar altimeter systems sharing a single 1.5 meter nadir-pointing antenna. The primary mission goal is to measure ocean height with a precision (depending upon wind speed and integration time) of 2–5 cm. Ocean height is determined from the measured signal travel time. Additional parameters are also measured. The leading edge slope (i.e., the rate at which the returned power increases) is a measure of significant wave height. The maximum of the returned power yields an estimate of radar cross-section that can be used to estimate surface wind speed.

Data from the NASA altimeter are processed by the TOPEX/Poseidon project at JPL to generate two primary data sets: the Sensor Data Record (SDR) and the Geophysical Data Record (GDR). The SDR contains the Level-0 data and ancillary data. The GDR contains the sea-surface height, significant wave height, associated corrections, and the measurement locations based on the Precision Orbit and Ephemeris (POE). The primary correction is for water vapor as derived from the TOPEX/Poseidon Microwave Radiometer (TMR). The POE product is generated at GSFC from ground-based laser observations, onboard GPS measurements, and the CNES DORIS tracking system. The project also generates an Interim Geophysical Data Record (IGDR) product to be used to support time-critical research missions. Special products (e.g., ocean transport of heat and geocentric ocean tides) will be generated by members of the science team. These data sets will be archived in and distributed by the JPL DAAC.

The JPL DAAC will archive and distribute the standard data products from the TOPEX/Poseidon mission. The data volumes of the four primary products are

Altimeter SDR	146 MB per day
TMR SDR	1 MB per day
NASA GDR	14 MB per day
CNES GDR	14 MB per day
TOTAL	175 MB per day

The JPL DAAC supports the TOPEX/Poseidon project by distributing quick-look and other products to selected investigators in support of the orbit determination efforts for the spacecraft. All data processing for the standard data products will be done by the TOPEX/Poseidon project. The JPL DAAC will archive only the most recent version of the standard products, and will archive all higher level data products as they are made available to the general scientific community.

¹The TOPEX/Poseidon project is described in “NASA Radar Altimeter for the TOPEX/POSEIDON Project,” by A. R. Zeiger, D. W. Hancock, G. S. Hayne, and C. L. Prudy, *Proc. IEEE*, Vol. 79, No. 6, pp. 810–826, June 1991. Detailed descriptions of the TOPEX/Poseidon data products and the plans for processing and archiving these products are contained in the *TOPEX/Poseidon Project Data Management Plan*, JPL document D–8972, October 15, 1991.

A limited PGS capability was developed to address the JPL DAAC requirements for higher level data product generation in support of the TOPEX/Poseidon mission. The first product to be generated is a merged Geophysical Data Record, incorporating the TOPEX and Poseidon altimetry GDR's into a common format in a single GDR. This product was developed in conjunction with the TOPEX/Poseidon Science Working Team and is published on CD-ROM media as a cooperative effort between the JPL DAAC and CNES. Level-3 global gridded parameter fields will be produced, archived, and distributed by the JPL DAAC. Additional data products will be produced as required by the Science Working Team.

2.5.5 NSCAT

The NASA Scatterometer (NSCAT) is scheduled to fly on the Japanese ADEOS satellite in February 1996. NSCAT is designed to provide global measurements of oceanic wind vectors at a spatial resolution of 50 km, with an accuracy of the larger of 2 m/sec or 10 percent in speed, and 2 degrees rms in direction (over the wind speed range 3–30 m/sec). An introduction to NSCAT and scatterometry in general is contained in “Spaceborne Radar Measurement of Wind Velocity Over the Ocean—An Overview of the NSCAT Scatterometer System,” by F.M. Naderi, M.H. Freilich, and D.G. Long, *Proc. IEEE*, Vol. 79, No. 6, pp. 850–866, June 1991. Some specific information is provided below on NSCAT data products.

The NSCAT project has defined and will generate the following standard products:

- **Level-0**—Raw data, by telemetry frames, organized and edited for time order, nonredundant and complete.
- **Level-1**—Engineering Data Record; time-ordered data converted to engineering units, ordered by revolution with global coverage.
- **Level-1.5**—Sensor Data Record I, s_0 product; Earth located s_0 (sigma-naught) cells in beams with flags, reversible, organized by revolution with global coverage with engineering data included.
- **Level-1.7**—Sensor Data Record II, s_0 Wind Vector Cell product; Earth located s_0 cells in subtrack wind vector cells with flags, data fields for wind retrieval organized by revolution, ocean coverage only.
- **Level-2**—Geophysical Data Record, Vector Wind Product; multiple wind vector solutions in wind vector cells with unambiguous wind flag, number of s_0 's used, s_0 flagging, organized by revolution, ocean coverage only.
- **Level-3**—Wind Map Product; time and space averaged wind vectors on a global, ocean grid.

The NSCAT telemetry, which will contain the observations and calibration and instrument engineering data, will be combined with orbit and attitude data and additional geophysical data to generate Level-1.5 data. This data set will contain Earth-located normalized radar cross-sections, s_0 . The Level-1.5

data will also contain flags to indicate those s_0 cells that contain excess water vapor or non-ocean data. The Level-1.5 data set will be reversible to Level-1.0.

Ocean-only observations will be selected to generate a Level-1.7 data set. Wind retrievals will be made at 50 km resolution by combining four 25 km cells. The Level-2 data set will contain all of the wind vectors that are an acceptable fit to the data, with the single vector selected by an ambiguity removal procedure flagged.

The NSCAT project will generate a single gridded Level-3 data set. This data set will be produced daily at a spatial resolution of 0.5° by 0.5° from simple averages of the Level-2 retrievals within each grid cell.

The NSCAT data will be reserved for members of the NSCAT Science Team during the instrument verification period. Approximately 6 to 9 months after launch, NSCAT data at Levels 1–3 will be packaged and archived by the JPL DAAC and made available to the general user community without restriction.

All data processing and reprocessing will be done by the NSCAT project. Extensive reprocessing is likely. Reprocessed data will replace archived data; only the most recent product versions will be supported by the DAAC. The JPL DAAC will generate higher level data products as required by the NSCAT Science Working Team and the scientific community.

2.5.6 ATLAS

The Atmospheric Laboratory for Applications and Science (ATLAS)¹ is a series of space shuttle flights that will monitor the radiant energy output of the Sun, examine potential responses of Earth's atmosphere to changes in solar energy, and verify global change assessments. The first flight in the series (ATLAS–1) was launched March 23, 1992, and the second on April 8, 1993. The ATLAS–1 flight included instruments for Earth, space, and astrophysics disciplines. The PI's of ATLAS Earth science instruments will provide their data to EOSDIS for archive and distribution. Data from the space and astrophysics instruments will be archived by NSSDC. Subsequent ATLAS missions will concentrate on atmospheric responses to solar energy input. The Shuttle Solar Backscatter Ultraviolet (SSBUV) experiment is comanifested with ATLAS–1 and subsequent ATLAS flights.

Three additional ATLAS flights have been scheduled or proposed for the 1990's.

- ATLAS–3 scheduled for launch **November** 1994.
- ATLAS–4 and ATLAS–5 are proposed for future launches in the mid- to late 1990's.

Levels 0–3 data products are expected to be archived from each Earth science experiment. The data volumes at this time are yet to be determined. The ATLAS–3 flight will be comanifested with the

¹The ATLAS mission is described in "The ATLAS–1 Shuttle Mission," by M.R. Torr and K.D. Sullivan, *EOS, Transactions Am. Geophys. Union*, Vol. 73, No. 10, March 10, 1992.

German SPAS/CRISTA (Shuttle Pallet Satellite/Cryogenic Infrared Spectrometers and Telescopes for the Atmosphere). Data archive plans for the SPAS/CRISTA are yet to be determined.

The Goddard DAAC is expected to archive Levels 0–3 data products from the following ATLAS–1 experiments, pending data availability from the individual investigators:

- ACR—Active Cavity Radiometer (solar).
- SOLCON—Solar Constant Radiometer.
- SOLSPEC—Solar Spectrum Radiometer.
- SUSIM—Solar Ultraviolet Spectral Irradiance Monitor.
- ATMOS—Atmospheric Trace Molecule Spectroscopy.
- GRILLE—Grille Spectrometer.
- MAS—Millimeter-wave Atmospheric Sounder.
- SSBUV—Shuttle Solar Backscatter Ultraviolet Spectrometer.

ATLAS–2, –3, and –4 will consist of ACR, SOLCON, SOLSPEC, SUSIM, ATMOS, MAS, and SSBUV (comanifested).

2.5.7 TRMM

The Tropical Rainfall Measuring Mission (TRMM) is a joint effort between NASA and Japan (NASDA) to measure precipitation occurring over the Tropics and subtropics (between 35°N and 35°S). TRMM is expected to be launched into a low-inclination, low-altitude orbit in August 1997, with an expected mission of at least 3 years.

Japan will provide one TRMM instrument, the launch vehicle, and launch services. NASA will provide four instruments, the spacecraft, observatory integration, and system testing. NASA will conduct mission operations, which includes command and control, and data acquisition, processing, and distribution. The TRMM observatory will carry five instruments:

- Precipitation Radar (PR), to be provided by Japan.
- Clouds and Earth's Radiant Energy System (CERES).
- Lightning Imaging Sensor (LIS).
- TRMM Microwave Imager (TMI).
- Visible Infrared Scanner (VIRS).

PR is an active microwave radar intended to directly measure rainfall rates. CERES is a single broad-band scanning radiometer, the heritage of which is based on ERBE, and is intended to continue to provide long-term measurements of Earth's "top of atmosphere" radiative fluxes. LIS is an imaging

radiometer that will map the distribution and variability of total lightning over Earth. TMI is a passive microwave imager collecting data in five bands between 10 and 91 GHz, designed to measure a wide variety of atmospheric and surface parameters. VIRS is a seven-channel imaging radiometer with visible, near-IR, and thermal-IR bands that will detect clouds, measure cloud properties and atmospheric moisture, and determine surface characteristics.

CERES and LIS are the first two EOS instruments scheduled for launch. All data processing and archive functions will be executed by EOSDIS. Data from LIS will be processed, archived, and distributed by the MSFC DAAC. CERES data and products are the responsibility of the LaRC DAAC.

The processing of data from PR, TMI, and VIRS will be done by the TRMM project. Data products will be generated from the individual instruments and combined observations. More detailed information on data products and processing will be included in a subsequent version of the SDP. It is expected that EOS will support the TRMM project by providing some type of catalog system functionality.

After validation, the TRMM data products will be archived and distributed by EOSDIS. Data and derived products from the PR, TMI, and the TRMM Ground Truth data set will become the responsibility of the MSFC DAAC. Products derived from combined TRMM and other instrument data may also be archived at MSFC. Data and derived products from the TRMM VIRS will be supported by the Goddard DAAC.

2.6 International Mission DAAC Data

Several international missions will generate Earth science data during the EOS era. This section presents the data sets that will be supported by the EOSDIS DAACs. At this time, definite information is available only on the ERS-1 and JERS-1 missions. This section will expand to cover additional missions as plans are developed and information becomes available.

ERS-1 Data—The ERS-1 spacecraft, launched by ESA in July 1991, carries microwave radar instrumentation to estimate sea-surface height, near-surface wind vectors, and other measurements relevant to the ocean's physical state. ERS-1 can also collect SAR images of the Earth's surface. The ASF DAAC is currently receiving and processing data from the ERS-1 SAR, as described in Section 3.1.1. The ERS-2 spacecraft is scheduled for launch in December 1994 or January 1995 and will carry a complement of instruments similar to that of the ERS-1 spacecraft. The European METEOSAT will launch in 1998, carrying many of the same instruments.

Data from the ERS-1 altimeter and scatterometer instruments will be made available to U.S. investigators through the U.S. Coordinating Investigators for the U.S. World Ocean Circulation Experiment (WOCE) Investigator Team and the Scatterometer Investigator Team. The ERS-1 altimeter data were distributed by the JPL DAAC to members of the U.S. WOCE team until January 1994, at which time ESA began direct distribution to this team. The availability of these data to the scientific community will be governed by ESA policy on data distribution. (These activities are described in the

JPL *Physical Oceanography DAAC ERS-1 Data Management Plan*, JPL Document D-9348, January 1992.)

JERS-1—The JERS-1 spacecraft was launched by Japan in February 1992. ASF is acquiring and processing direct-broadcast SAR data. The JERS-1 SAR data have a spatial resolution of 18 m, over a 75 km swath width, with a recurrent period (repeat cycle) of 44 days. An identical set of low-level products is being generated for each of the JERS-1 and ERS-1 SAR's, with data from both instruments combined to produce a single set of higher level products.

2.7 Affiliated Data Centers

To support EOS product generation, NASA will require operational access to real-time or near-real-time data that exceeds the service customarily available. NASA will enter into special agreements for those services. This may involve NASA assistance to enable the other data center to meet the NASA service requirement. This special agreement establishes the data center as an Affiliated Data Center (ADC).

NASA will work within the GCDIS to cooperate with other U.S. agencies to provide research scientists with access to global change data and information from across the participating agencies. NASA will also cooperate with international researchers, primarily through EO-ICWG and CEOS. These cooperative arrangements, which are intended to ensure research access to data and information, are separate from the operational requirements that lead to ADC agreements.

In the EOS time frame, data in the archival centers of the IEOS agencies will be available to U.S. users. These centers include the European Space Agency (ESA), the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), the Japanese Science and Technology Agency (STA), the National Space Development Agency of Japan (NASDA), the Ministry of International Trade and Industry of Japan (MITI), the Japan Environment Agency (JEA), and the Canadian Space Agency (CSA).

2.8 Data Archival Schedules

The schedules for building up the future DAAC data sets are provided in this section. Only the data milestones that are relatively firm are included in the following tables. The tables will be revised and expanded to include additional data sets as the plans become more firmly established. The following tables are intended to present the schedule for data availability. Additional information on the products is to be found in Sections 3 and 4 and Appendix A.

2.8.1 DAAC Data Migration Schedule

The schedule for migrating data sets from one DAAC to another or from a non-EOSDIS data center to a DAAC is presented in Table 2.5.

Data Set	From	To	Start	Finish
Digital SAR Data	JPL	EDC	TBD	TBD
PLDS Data	GSFC, JPL, ARC	ORNL, EDC	93	94
Radiation Budget, Aerosol, Chemistry Data	NCDS	LaRC	93	3/94

Table 2.5 Data Migration Schedule

2.8.2 New DAAC Data Sets

The schedule for DAAC archiving of new data products generated from existing data is presented in Table 2.6. This table includes the Pathfinder products.

2.8.3 Data From Earth Probes and Related Missions

The schedule for initiating the EOSDIS archive and distribution of data transferred from Earth Probe Mission data centers or for the availability of mission data sets from the International Agency archives is presented in Table 2.7.

Input Data	Product	Proc. Center	Archive	Date Avail.
Part 1: Pathfinder				
AVHRR GAC Radiance (from NOAA)	Level-1 AVHRR Pathfinder Input Data	GSFC	JPL	8/94
Level-1 AVHRR Pathfinder	Atmosphere Products; L-3	NOAA	LaRC	TBD
Level-1 AVHRR Pathfinder	Land Products; L-3	GSFC	GSFC	5/93
Level-1 AVHRR Pathfinder	Ocean Products; L-3	JPL	JPL	8/94
Nimbus-7 SMMR	Reprocessed Brightness Temperature	JPL	MSFC	12/94
SSM/I Level-1B	SSM/I Level-2 Atmosphere, Land, and Snow & Ice Products	MSFC	MSFC, NSIDC	7/94
TOVS Level-1 Radiance Data (from NOAA/NCAR)	TOVS Collocated Instr. Data (HIRS/2, MSU, SSU)	NOAA / NCAR	GSFC	8/94
Level-1 TOVS HIRS/2, MSU, SSU	Path A Atmosphere, Surface, Cloud Parameters; L-2,L-4	GSFC	GSFC	10/94
Level-1 TOVS HIRS/2, MSU	Path A,B Atmosphere, Surface, Cloud Params; L-3	GSFC, LMD	GSFC	7/94 (A), 9/94 (B)
Level-1 TOVS MSU only	Path C Deep Layer Temps & Ocean Precipitation; L-3	MSFC, NOAA	MSFC, NOAA	3/94, 7/94
Level-1 TOVS HIRS/2,MSU	Path P Polar Retrievals	U. Wash	NSIDC	7/94
Landsat Pathfinder	MSS and TM Level-2 "Consistent P" Products	EDC	EDC	TBD
Landsat Pathfinder	Humid Tropical Forest Inventory Products	U of NH U of Md.	EDC	TBD
Landsat Pathfinder	North American Landscape Characterization Triplicates	EPA	EDC	TBD
Landsat Pathfinder	Global Land Cover Test Sites	EDC	EDC	TBD
Part 2: Other Products				
In situ	TOGA CD-ROM	JPL	JPL	6/94
ERS-1 Altimeter	Altimetry CD-ROM	JPL	JPL	11/94
AVHRR 1-km	Global 10-day Vegetation Composites and Daily Orbital Segments	EDC	EDC	7/94
Digital Chart of the World	Gridded Elevation Data	EDC	EDC	10/94

Table 2.6 New Data Products Schedule

Mission	Agency	Launch Date	Data Avail. Date	Archive
Part 1: Earth Probes				
Meteor-3 TOMS	NASA	Aug. 15, 91	mid 94	GSFC
UARS	NASA	Sept. 12, 91	12/93	GSFC
ATLAS	NASA	March 92, 93, 94, 95, 97	TBD	GSFC
EP-TOMS	NASA	July 94	TBD	GSFC
SeaWiFS	NASA	April 95	12/94	GSFC
LIS Precursor	NASA	1995	TBD	MSFC
TRMM	NASA/Japan	Aug. 1997	TBD	TBD
Part 2: International Partners				
ERS-1	ESA	July 91	Dec 91	ASF, ESA, JPL
JERS-1	NASDA	Feb. 92	Apr 93	ASF, NASDA
ERS-2	ESA	Apr 94	TBD	ASF, ESA
ADEOS	NASDA	Feb 96	TBD	JPL, NASDA, GSFC (TOM/4)
ADEOS II	NASDA	Feb 99	TBD	JPL, NASDA
ENVISAT	ESA	Feb 98	TBD	JPL, ESA
Radarsat	Canada	Aug. 95	TBD	ASF, TBD

Table 2.7 New Mission Data Schedule

3.0 July 94 DAAC Science Data Holdings and Status

This section describes the DAACs' science data holdings as of July 1994. Some information pertaining to the status of the data sets, and DAAC plans for building up the data sets, is provided along with the data set descriptions.

The information presented in each DAAC subsection is organized by primary instrument data sets (e.g., Landsat, ERBE), with the secondary data sets grouped (e.g., additional data) as appropriate for each DAAC. Certain institutional data holdings, i.e., non-DAAC, are included in the following discussion.

The following discussion of the data sets is a brief summary. Details are presented in Appendix A. As defined in the SDP, data priority is intended to show the scientific importance of each data set. Level of service indicates how the scientists will use and access the data. There is often a direct correspondence between priority and service, but this is not always the case. As an example, the AVHRR Level-1B Pathfinder data set is one of the highest priority. However, since these data will be employed primarily in large-scale reprocessing by sophisticated users, only a low service level is needed. Data set priorities were determined by the DAAC Scientists and Science Advisory Groups, and level of service was defined by the DAAC User Working Groups. Indeed, the DAAC User Working Group is revising the definition of level of service. A new scenario for defining level of service is expected to be approved in fall 1994, and will be used in the preparation of the next version of the Science Data Plan.

Parameter-level information can be obtained from the Global Change Master Directory (GCMD), the Science Processing Support Office (SPSO) at GSFC, and the individual DAACs through their User Support Offices.

3.1 Alaska SAR Facility (ASF)

The Alaska SAR Facility (ASF) DAAC processes, archives, and distributes data from the ERS-1 and JERS-1 SAR instruments and provides access to data from existing institutional holdings including AVHRR and Landsat data. Users are supported by the Archive and Catalogue System (ACS) for SAR data and data products, by the Interactive Image Analysis System (IIAS) for user tools, algorithms, and science support; and by the University of Alaska, Fairbanks, GeoData Center (GDC) for heritage data sets. Table 3.1 summarizes the existing data holdings, with more detail presented in Appendix A, Table A-1.

Because they are operated by International Partners, there are restrictions on the distribution of ERS-1 and JERS-1 data held by ASF. The ASF DAAC (with NASA Headquarters approval) established a formal data policy that provides the terms under which users may obtain data. ASF distributes SAR data to investigators approved by NASA or by the relevant sponsoring agency (ESA for ERS-1, NASDA for JERS-1 data). Potential users must submit a proposal to NASA through the ASF DAAC. The proposal is reviewed by ASF and NASA and, when approved, the investigator must sign a research agreement that specifies the conditions on use of the data. Only approved research and

applications users can receive SAR data from ASF. All other users are directed to ESA or NASDA. Details of the data policy and copies of the research agreement are available from the ASF User Services Office (see Table 1.2 for contact information).

All other data held by ASF are available without restriction.

Data Type	Volume (GB)	Data System	Remarks
JERS-1 SAR Signal Data	6,620	ACS	Raw Level-0 data; distribution restrictions apply
JERS-1 SAR Products	311	ACS	Level-1 and -2 data; distribution restrictions apply
ERS-1 SAR Signal Data	43,790	ACS	Raw Level-0 data; distribution restrictions apply
ERS-1 SAR Products	4,103	ACS	Level-1 -2, and -3 data; distribution restrictions apply

Table 3.1 ASF DAAC—Summary of Data Holdings as of July 1994

3.1.1 SAR Data

The Alaska SAR Facility currently acquires and processes SAR data from the ERS-1 and JERS-1 satellites. A daily average of 37 and 22 minutes of direct broadcast data are received from ERS-1 and JERS-1, respectively. ERS-1 data have been available to the science community since January 1992, with JERS-1 data being available since 1993.

An identical set of low-level products are generated for ERS-1 and JERS-1 SAR's. The collection includes signal data and processed image data. A single set of higher level geophysical products will be generated using ERS-1 data. Each data set is discussed below.

The primary SAR data archive media are magnetic tape and optical disk. A photographic product archive of processed SAR data is also available. All processed data, whether digital or analog, are cataloged in the ACS.

Computer Compatible Signal Data (CCSD)—SAR signal data represented as complex integers in byte-aligned 8-bit bytes. This data product is for investigators who wish to correlate their own data. A CCSD scene corresponds to 12 seconds of signal data from a user-specified satellite pass. Each CCSD order fills two or three standard computer tapes. This product is generated only on user request.

Complex Data—SAR data reprocessed to 1-look with approximately 10 m resolution covering a 30 by 50 km area. As the name implies, the data format is a complex integer (16I, 16Q). This data product contains information about the backscatter amplitude and phase, which is useful for interferometry studies of topography or feature motion. The user specifies a satellite pass, target latitude and

longitude, or time corresponding to the center of the desired area. This product is only generated on user request.

Full-Resolution Data—SAR data processed to 4-looks resulting in 30 m resolution and 12.5 m pixel spacing over a 100 by 100 km area. These are 8192 by 8192 pixel, 8-bit (64 MB) amplitude images. These standard products are created routinely when new data are collected and archived at ASF.

Low-Resolution Data—Data derived by an 8 by 8 spatial averaging of full-resolution images, resulting in a 240 m resolution and 100 m pixel spacing. The product is 1024 by 1024 pixels by 8 bits, or only 1 MB in size. These products are routinely processed and archived at ASF.

Geocoded Full- and Low-Resolution Data—Data generated from standard low- and full-resolution images digitally reprojected to match either the Universal Transverse Mercator or Polar-Stereographic map projections. They are created on user request.

In addition to the standard image products described above, a set of geophysical products is processed, archived, and distributed to the science community. These products address specific sea-ice and ocean research activities of the ASF DAAC user community.

Ice Motion Vectors—Vectors are determined by comparing two geocoded low-resolution SAR images acquired on different dates, typically 3 days apart. The algorithm matches features corresponding to sea-ice floes between the images, and generates a vector array describing the velocity field for the area in common. Vectors are derived on a 5 km grid spacing, nominally over an area 100 km by 100 km in size.

Ice-Type Classification—This product is generated from low-resolution images that are classified based on backscatter differences of ice-type categories. The resulting classification is applied on a pixel-by-pixel basis to generate an ice-type image with 100 m pixel spacing covering a 100 by 100 km area.

Ice-Type Fraction—This product is derived from the ice-type classification image, summarized over the same 5 km grid used to generate the ice motion vector product. The resulting product lists the fraction of ice classes for each grid location.

Wave Product—Data sets are generated for areas of open water from full-resolution SAR data. Six by six km portions of the image are extracted from the scene and used to derive wave direction and wavelength information. The final product, in the form of vector files for each patch, is archived and distributed to users.

3.1.2 Additional Data

The ASF DAAC provides access to additional data sets at the University of Alaska including long-term collections of Landsat, NOAA AVHRR data, and aerial photographs. The collections are principally

archived on photographic media and range from the early 1970's; they primarily cover the region within view of the ground station located in Fairbanks, Alaska, which includes all of Alaska, surrounding waters, portions of western Canada, and the Russian Far East.

The Landsat Data Collection—This dates back to the beginning of the program with ERTS-1 in 1972. It contains approximately 14,000 Alaskan scenes. The majority of the data are analog; only about 200 scenes are available digitally. The Level-1 products were originally generated at NASA and EDC. Between 1984 and 1991, the Geophysical Institute, University of Alaska, operated a Landsat Quick-Look System to acquire, process, and archive full-resolution Level-1 Multispectral Scanner System (MSS) photographic data over Alaska and surrounding lands and seas. Portions of this data set are unique and are not available from any other source. The Landsat data are archived at the GeoData Center, Geophysical Institute, University of Alaska.

AVHRR HRPT 1 km Data—These data, covering the station mask of NOAA's Gilmore Creek Command and Data Acquisition Station, have been archived since 1974. The collection is composed of Level-1 data acquired daily and archived in analog form on 10" film transparencies. An increasing volume of digital field-station data is also being acquired. The field-station data consist of three spectral bands, normally channels 1 (visible), 2 (near-infrared), and 4 (thermal-infrared), with 8-bit dynamic range. An HRPT station has been in place since mid-1993 to enhance AVHRR data acquisition activities at the Geophysical Institute.

NASA High Altitude Aerial Photography—Maintained by the University of Alaska, this statewide collection consists of approximately 5,300 photographs of two data types: color IR 9-inch film transparencies at 1:60,000 scale, and black-and-white 9-inch negatives at 1:120,000. The program is sponsored by a consortium of Federal and State agencies and receives heavy use by the user community.

Unidata—This data set is a long-term record of meteorological parameters including temperature, relative humidity, and wind velocity.

3.2 EROS Data Center (EDC)

The Land Processes DAAC builds on the services of the U.S. Geological Survey's EROS Data Center (EDC). EDC currently archives and distributes a wide variety of satellite and airborne remote sensing data and data products, selected digital topographic and cartographic data, and other in situ data. EDC is the site of the National Satellite Land Remote Sensing Data Archive and has responsibility for long-term preservation and distribution of Landsat and other land-related remotely sensed data sets. Such data sets are potentially relevant to interdisciplinary Earth science and global change studies, and are available for searching and ordering through EOSDIS Version 0 IMS. **Several of these data sets are described below and summarized in Table 3.2, with additional detail supplied in Table A-2 of Appendix A.**

Data Type	Volume (GB)	Data System	Remarks
AVHRR LAC and HRPT	3,800	GLIS	1 km, digital data
Global Change Landsat TM	750	GLIS	NASA data, restrictions apply (see Section 2.4.5)
Airborne Sensor Data	154	GLIS	Volume from NASA sensors TIMS, TMS, and NS-001

Table 3.2 EDC DAAC—Summary of Data Holdings as of July 1994

3.2.1 AVHRR Data

Since April 1992, the Land Processes DAAC has acquired, archived, processed, and distributed global daily AVHRR 1 km data via a core network of 26 ground receiving stations located throughout the world. Individual observations, which comprise this near-daily coverage of the Earth's land surface, are reformatted into continuous pole-to-pole orbital segments. Both original observations and orbital segments are archived by the Land Processes DAAC at EDC and are distributed to the science community. Other AVHRR products, including HRPT and LAC data, and NDVI products, are permanently archive by EDC and are available through the Global Land Information System (GLIS).

3.2.2 Additional Data

The following paragraphs summarize **several** of the datasets held at EDC, and which are available through the Land Processes DAAC.

Landsat Data—A moderate amount of Landsat TM data collected for NASA's global change program is available as Land Processes DAAC holdings. A much more extensive quantity of Landsat MSS and TM data are available at the EROS Data Center. Effective February 1993, all MSS data are available without commercial restrictions. All Landsat TM data acquired to date are the property of the U.S. Government. However, the TM archive is currently used by the Landsat commercial operator for commercial sale. USGS is converting these data to new magnetic media to ensure long-term preservation. By the end of FY96, this conversion will be complete. See Section 2.1.4 for a discussion of the Landsat data policy.

Airborne Sensor Data—EDC archives and distributes Side-Looking Airborne Radar (SLAR) data of the U.S. acquired by the USGS SLAR Program, and archives and distributes some, but not all, data acquired for science investigators by the NASA Aircraft Programs. NASA airborne sensors for which some data are available include the 6-channel Thermal Infrared Multispectral Scanner (TIMS), the 12-channel Thematic Mapper Simulator (TMS), the 8-channel NS-001 TMS, the 11-channel M²S, and the 10-channel Ocean Color Imager (OCI).

DEM/DLG Data—EDC archives and distributes the USGS 1:250,000 series (3 arc second) digital elevation model (DEM) data set of the U.S. This data set was derived from Defense Mapping Agency (DMA) digital terrain elevation data (DTED). Also available through the EDC Customer Service Office are existing 1:24,000 and 1:100,000 DEM's of the U.S. EDC also archives and distributes USGS 1:2,000,000 scale digital line graph (DLG) data for the United States. USGS 1:24,000, 1:100,000, and 1:250,000 scale DLG data and 1:250,000 scale land use/cover data of the U.S. are also available through the EDC User Support Office. **In addition, gridded elevation data with 1 km spatial resolution is scheduled to be available from the EDC DAAC in October 1994.**

3.3 Goddard Space Flight Center (GSFC)

The Goddard DAAC supports a wide variety of data related to global change research. Active projects cover topics such as ocean phytoplankton blooms, desertification of land surfaces, global-scale interannual differences in temperature and precipitation patterns, and stratospheric ozone depletion. Several of these areas have a long history of support at GSFC through the former discipline data systems of National Climate Data Center (NCDS) and Pilot Land Data System (PLDS) as well as through the distribution of the complete archive of CZCS Levels 1–3 data products. The GSFC DAAC concentrates on providing operational support for long-term reprocessed data sets such as the AVHRR Land and TOVS Pathfinder products in addition to new data sets such as UARS and 4-Dimensional Data Assimilation (see Section 2.4). The July 1994 GSFC data holdings that became part of the Goddard DAAC are summarized in Table 3.3, with additional detail supplied in Table A–3 of Appendix A.

Data Type	Volume (GB)	Data System	Remarks
Land Biosphere	52	DAAC	AVHRR Land Pathfinder; dailies & composites
Ocean Biology	757	CZCS/DAAC	CZCS archive; currently being integrated into DAAC system
Upper Atmosphere	48	DAAC	UARS and TOMS L3 data products
Atmospheric Dynamics	145	DAAC	TOVS Pathfinder, 4-D Assimilation, TOGA–COARE
Heritage Climate/Land	1	DAAC	Data sets transitioned from former NCDS (mostly GEDEX) and PLDS data systems

Table 3.3 GSFC DAAC—Summary of Data Holdings as of July 1994

Data at the GSFC DAAC are stored and distributed on various media, with varying levels of support through different systems. Data are currently archived on VHS tape, optical disk, 8 mm tape, and CD-ROM. Data may be distributed to users on a variety of media or, in some cases, transmitted electronically from on-line staging areas using File Transfer Protocol (FTP).

3.3.1 Land Biosphere Data Sets

AVHRR Land Pathfinder Data—Beginning in the second half of FY93, the Goddard DAAC began to archive and distribute the AVHRR Land Pathfinder data derived from the NOAA series of afternoon Polar Orbiting Satellites (NOAA-7, -9, and -11). The initial time period being archived is the so-called “benchmark period” extending from April 1987 through November 1988, which all Pathfinders are using as a reference for subsequent intercomparison studies. Daily and 10-day composites of 5-channel radiances and the NDVI are generated on a Goode’s homolosine projection in the HDF format. A low-resolution daily browse product was introduced into the archive beginning in mid-April 1994. All products are stored in standard UNIX compressed form on VHS tape in the DAAC near-line mass storage system. Tools for continental subsetting of the data are available for distribution along with each data order.

3.3.2 Ocean Biology Data Sets

CZCS Data—The reprocessed CZCS archive contains Level-1 full- and reduced-resolution image data, Level-2 derived parameters, and Level-3 gridded composites at varying levels of spatial and temporal resolution. Derived geophysical parameters include pigment concentrations, water-leaving radiances, aerosol radiance, and diffuse attenuation coefficient.

As of the end of FY92, the CZCS data are supported fully by the Goddard DAAC and are considered an important part of the DAAC holdings. CZCS data are stored on SONY optical platters. The archive is considered stable, but a possibility exists for reprocessing the data some time in the future, using algorithms that are consistent with those being implemented for the SeaWiFS instrument. The data are supported via the CZCS inventory and browse system. For remote users without access to video disk players, VHS tapes can be generated that allow users to browse data for scene selection. In December 1993, an effort was initiated to migrate all of the CZCS data from the SONY platters to the DAAC Cygnet jukebox. The migration of the Level-1 data was completed as of June 1994, and the scheduled completion time for the remaining CZCS Levels 1A, 2, and 3 migration activities is December 1994. This migration is being performed in parallel with the operational request processing, ordering, and distribution of the CZCS data products.

3.3.3 Upper Atmosphere Data Sets

UARS Data—Data from the Upper Atmosphere Research Satellite (UARS) became available from the GSFC DAAC beginning in FY94 upon expiration of the 2-year embargo period for the first year of data in the UARS Central Data Handling Facility (CDHF). By May 1994, all Level-3A subtypes for each of the nine instruments (MLS, ISAMS, SOLSTICE, HRDI, PEM, WINDII, CLAES, HALOE, and SUSIM) will have been archived at the DAAC for the first year of the satellite operations (September 1991–August 1992). In addition, correlative data, including the United Kingdom Meteorological Office (UKMO) Assimilated Data and NOAA’s National Meteorological Center (NMC) Analyzed data for the same time period, will have been released to the DAAC by the UARS CDHF. All

files received from the CDHF have been reformatted from their native VAX/VMS file structure to a direct-access UNIX file structure. Current plans call for the second and third years of UARS level-3A data to be archived in the DAAC by the end of September 1994 and December 1994, respectively. All UARS data are stored in uncompressed form in the DAAC near-line mass storage system.

TOMS Data—The long-term time series of version 6.0 Nimbus-7 TOMS total ozone data was previously available through the former NCDS data system in the CDF format as well as through NSSDC in the original GRIDTOMS binary format. The GSFC DAAC has converted all of the Level-3 GRIDTOMS data from 1978 through 1993 to the HDF format and will support this data set beginning in April 1994. All TOMS data from subsequent missions (i.e., Meteor-3) and reprocessing of old data (i.e., version 7.0 Nimbus-7 TOMS) will be submitted to the DAAC in the same HDF format for the purposes of internal consistency and ease of use across platforms.

3.3.4 Atmospheric Dynamics Data Sets

TOVS Pathfinder Data—By July 1994, the GSFC DAAC will provide operational support for the TOVS Pathfinder Path A and Path B data products provided by the Goddard Laboratory for Atmospheres (GLA) and the Laboratoire Meteorologie Dynamique at the Ecole Polytechnique, respectively. The initial temporal coverage will be the April 1987–November 1988 benchmark period for the NOAA-10 satellite and will include the Level-3 daily, 5-day, and monthly fields listed in Section 2.4.2 mapped to a 1-degree, equal-angle grid. All data products from both Paths are written out using the same HDF implementation to facilitate the intercomparison and validation efforts that precede release of the data to the general user community. As is the case with AVHRR Land Pathfinder, the TOVS Pathfinder data are archived in the GSFC DAAC near-line mass storage system in standard UNIX compressed form. Software for reading and subsetting the HDF parameter arrays is distributed to users upon request.

4-D Assimilated Data—The Data Assimilation Office (DAO) at GSFC generates a multiyear (1985–1989) gridded global atmospheric data set for use in climate research. A subset in time series format will be archived at the GSFC DAAC and will include all surface and upper air prognostic variables as well as a large number of diagnostic quantities such as heating rates, precipitation, surface fluxes, cloud fraction, and height of the boundary layer. The analysis makes use of rawinsonde reports, NOAA satellite retrievals of geopotential thickness, cloud motion winds, and other in situ measurements. By July 1994, the GSFC DAAC will have archived about one-half of the 150 GByte total.

TOGA-COARE Field Data—The GSFC DAAC was tasked by NASA Headquarters to provide support for the NASA funded PI's involved with the TOGA-COARE (Tropical Ocean Global Atmosphere-Coupled Ocean-Atmosphere Response Experiment) field experiment, which took place from November 1992 to February 1993. The primary mission of the experiment was to study the effects of the tropical warm pool of the South Pacific on global convection and heat transfer patterns. Initial DAAC support involves coordination of the receipt and exchange of field data among the investigators and providing information with regard to data formats and data set documentation. By July 1994, the DAAC expects to have archived about half of the 127 GB of data collected from

instrumentation aboard aircraft (DC-8, ER-2), ships, and satellites (primarily the Geostationary Meteorological Satellite, GMS). All PI's will have proprietary rights to this data until July 1995, after which it will be openly accessible to the general user community.

3.3.5 Data Sets From Heritage Data Systems

NCDS Data—In accordance with the transition plans for the GSFC heritage data systems, a large part of the former NCDS data holdings has been migrated to other DAACs or archive centers during the first half of FY94. In particular, the large volume of ERBE, ISSCP, and FIRE data sets has been transitioned to the LaRC DAAC along with the SAGE I and SAGE II data products. Many other data sets are currently supported by their official archive sites, including NOAA (CAC-SST, NMC analyses), NCAR (GISS Global Surface Vegetation, COADS Monthly Summaries), and NSSDC (Nimbus-7 Levels 1-3 data sets). The remaining data sets are supported by the GSFC DAAC as part of the Greenhouse Effect Detection Experiment (GEDEX) CD-ROM, which also includes several of the previously mentioned transitioned data sets, specifically ERBE, ISSCP-C2, SAGE I and II, and CAC-SST, among others. Although the NCDS system is no longer operationally supported by GSFC, the GEDEX CD-ROM is available to users as an additional supported data product in the DAAC. Users wishing specific details on the disposition of the NCDS data sets should contact the GSFC DAAC User Services Office.

PLDS Data—As in the case of NCDS, the GSFC DAAC no longer operationally supports the PLDS data system, which included nodes at GSFC, JPL, and ARC. The FIFE (GSFC node) and OTTER (AMES node) data sets have been moved to the Oak Ridge DAAC along with spectral laboratory data previously residing in the JPL node. Also migrating from the JPL node to the EDC DAAC are some aircraft data that support detailed studies of land processes and land-surface climatology. Two data sets will be incorporated into the DAAC holdings from the GSFC node in the near future: the Microwave Vegetation Index of Choudhury derived from the Nimbus-7 SMMR and the Optical Thickness data set of Holben derived from ground-based spectrophotometers. Any other data set not transitioned to another DAAC or archiving institution will be returned to the PI responsible for that data set.

3.4 Jet Propulsion Laboratory

The JPL DAAC is based on the NASA Ocean Data System (NODS), which was created to facilitate access to satellite and related oceanographic data and to be responsible for archiving and preserving Level-0 and all higher level data from the Seasat mission. Beginning in 1990, the role of the JPL DAAC was expanded to include responsibilities for the data from the TOPEX/Poseidon, NSCAT, SeaWinds, EOS Altimeter, and other satellite missions. The data holdings as of July 1994 are summarized in Table 3.4, with additional detail in Table A-4 of Appendix A.

Data Type	Volume (GB)	Data System	Remarks
TOPEX/Poseidon	122.9	DAAC	Sensor data record and geophysical parameters
Nimbus-7 SMMR	0.6	DAAC	Reprocessed brightness temperature and products
NOAA AVHRR / MCSST	6814.0	DAAC	Oceans Pathfinder and Univ. of Miami multichannel SST
CZCS and AVHRR CD-ROM	3.0	DAAC	Combined pigment concentration and SST
Altimeter Data	7.0	DAAC	Geophysical parameters from Geosat and GEOS-3
Seasat Data	97.3	DAAC	Raw data and derived products from the Seasat Altimeter, Scatterometer, SMMR, and VIRR
DMSP SSM/I	22.8	DAAC	Geophysical parameters
Supporting Data	7.1	DAAC	Geophysical parameters

Table 3.4 JPL DAAC—Summary of Data Holdings as of July 1994

JPL DAAC data sets include information relating to ocean circulation, air–sea interactions, physical forcing of the ocean surface, and the fluxes across the surface, including measurements derived from remote sensing observations of the ocean, the relevant in situ data, documentation, and software for displaying and reading the data. These holdings include the SDR and GDR products for all sensors from the Seasat mission (except the Seasat SAR). Higher level data products generated from Seasat, the GEOS-3 altimeter, the Geosat altimeter, the DMSP–SSM/I Ocean Data Products, the Nimbus-7 SMMR Ocean Data Products, the NOAA–TOVS; global MCSST products from the NOAA AVHRR; and coregistered ocean data products from the NOAA MCSST and Nimbus-7 CZCS.

The JPL DAAC archives and distributes the standard data products for the TOPEX/Poseidon mission, and generates, archives, and distributes additional Level-2 and higher level data products from this mission (see Section 2.5.4). The DAAC will also package, archive, and distribute the standard data products for the NSCAT/ADEOS mission. The JPL DAAC will generate, archive, and distribute the AVHRR Pathfinder ocean products.

Supporting data available from the JPL DAAC include the Fleet Numerical Oceanographic Center (FNOC) wet and dry tropospheric corrections for altimeter data. In situ data from the TOGA program and appropriate software for the manipulation and study of the data are also included in the archive holdings.

Data in the JPL DAAC archive are listed in the NASA Master Directory. The JPL DAAC will frequently publish and distribute the Contents of the *JPL Distributed Active Archive Center (DAAC) Archive* to alert the scientific community of its holdings.

3.5 Langley Research Center (LaRC)

The Langley DAAC activities focus on the development and operations of the DAAC Information Management System (IMS) and Data Archive and Distribution System (DADS). These activities include creating data set metadata, populating data sets into the archive, converting selected data sets into the EOS standard format (HDF), developing documentation, and staffing the User and Data Services support office. In addition to these DAAC-specific activities, processing and validation of data from the ERBE, SAGE, SAM II, SRB, MAPS, GTE, and FIRE experiments are ongoing at LaRC. July 1994 data holdings are presented below and summarized in Table 3.5. More detailed information is given in Table A-5 of Appendix A.

Data Type	Volume (GB)	Data System	Remarks
ERBE Level-0 Data and Products	426	DAAC	Data from ERBS, NOAA-9,-10; ongoing
ISCCP	239	DAAC	Cloud analysis data
SAM II and SAGE Data and Products	112	DAAC	Data from Nimbus-7, AEM-2, ERBS; Nimbus-7 and ERBS; ongoing
Surface Radiation	1	DAAC	Processed shortwave Surface Radiation Budget (SRB) data sets; ongoing
Field Experiments	325	DAAC	GTE and FIRE data archives
Additional Data	1		MAPS archives

Table 3.5 LARC DAAC—Summary of Data Holdings as of July 1994

3.5.1 ERBE Data

The largest volume data sets held at LaRC are the Earth Radiation Budget Experiment (ERBE) data sets from the ERBS, NOAA-9, and NOAA-10 satellites. These data are processed at LaRC under the auspices of the ERBE team. Data from the nonscanner ERBE instrument continue to be collected and processed.

With the start of initial operations in January 1993, the Langley DAAC archived and distributed ERBE data. The ERBE Level-3 S-4G product was converted to HDF. It is maintained on an optical cartridge jukebox and is available to users via ftp. The ERBE S-8 and S-7 data sets are also available via ftp; however, the data are stored in the native format on the optical jukebox. Other ERBE products are maintained in their native formats on an Aquidneck Optical Disk system.

3.5.2 ISCCP Data

The second largest volume of data sets held at LaRC are the cloud analysis products of the International Satellite Cloud Climatology Project (ISCCP), called Stage B3, Stage C1, and Stage C2 data. These data are processed at the Goddard Institute for Space Studies (GISS) and are archived at the Langley DAAC. Stage B3 data represent global radiances. These data are in native format and are maintained on 3480 tapes. Stage C1 and C2 data are constructed from the B3 radiances. Stage C1 data represent global, merged results reported every 3 hours. Stage C2 data are the monthly averages and summary statistics of the Stage C1 quantities. Stage C1 data are available in native format and Stage C2 data are available in both native format and HDF. Both data sets are maintained on an optical cartridge jukebox. Stage C2 Monthly Cloud data from July 1983–December 1990 are also available on CD-ROM.

3.5.3 SAM II, SAGE I, and SAGE II Data

The third largest volume data sets held at LaRC are the aerosol and trace gas data sets from the SAM II and SAGE I and II satellite experiments. The SAM II data set came on-line in Spring 1994. SAGE II data continue to be processed at LaRC and are archived under the auspices of the SAGE II team. Archival and distribution of specific higher level products are provided by the Langley DAAC. These products are held on an optical cartridge jukebox and include the SAGE II Ozone Monthly and SAGE II Cloud Occurrence Monthly Averages data sets in HDF, and the Level-2 SAGE I and SAGE II Aerosol Profile data sets available in HDF and native format.

3.5.4 SRB

Surface Radiation Budget (SRB) monthly and daily shortwave parameters are currently available for the time period March 1985 to December 1988. The SRB data sets are derived from the ISCCP C1 and the ERBE data products. SRB results are generated using the Pinker and Staylor algorithms. The SRB data package, consisting of six files for each month, is available from the Langley DAAC via ftp or on 4 mm, 8 mm, or 6250 tape. A CD-ROM is also available and contains data from March 1985 to December 1988. HDF read software for UNIX systems and read and display software for IBM PC and Apple Macintosh platforms are included with the CD-ROM.

3.5.5 MAPS

Tropospheric carbon monoxide data from two Measurement of Atmospheric Pollution from Satellites (MAPS) shuttle flights will be added to the Langley DAAC archive in 1994. Data from two shuttle missions that flew in 1994 will also be archived in 1995. Data from all four MAPS flights will be incorporated into the DAAC.

3.5.6 Field Experiments—GTE and FIRE

GTE—Data from the Global Tropospheric Experiment (GTE) are archived by the GTE Project at the Langley DAAC. The Arctic Boundary Layer Expedition (ABLE 3A) is a component of the NASA Global Tropospheric Experiment sponsored by the NASA Tropospheric Chemistry Program. ABLE 3A was conducted in Arctic and sub-Arctic regions of North America and Greenland during July and August 1988. This campaign represents the first comprehensive investigation of the sources, sinks, and distribution of trace gas and aerosol chemical species in a northern high-latitude region during summer months. Data from ABLE 3A are available in native format via ftp or Version 0 standard media, and work is ongoing to ingest data from additional GTE experiments.

FIRE—The First ISCCP Regional Experiment (FIRE) is an ongoing multiagency program designed to promote the development of improved cloud and radiation parameterizations for use in climate models, and to provide for assessment and improvement of ISCCP products. FIRE combines modeling activities with satellite, airborne, and surface observations to study two types of climatically important cloud systems—cirrus and marine stratocumulus—that have important roles in the climate system by virtue of their extensive physical extent, persistence, and radiative effects. Data from four Intensive Field Observations (IFO's) are currently available from the Langley DAAC. FIRE Cirrus I (Wisconsin), FIRE Marine Stratocumulus (St. Nicolas), FIRE II (Kansas), and ASTEX (Azores) data are available via ftp, 4 mm, 8 mm, or 6250 tapes. Future FIRE experiments will also be archived at the DAAC.

3.6 Marshall Space Flight Center (MSFC)

The MSFC DAAC draws its expertise from several ongoing research efforts at the MSFC Earth Science and Applications Division. The Marshall DAAC is using the experience gained from the WetNet project, the SSM/I Pathfinder project, the Global Atmospheric Temperature Variability study, and lightning detection and atmospheric electricity research.

The Marshall DAAC is developing an on-line data archive, search, and retrieval system to provide an integrated inventory of all Earth science data that it holds. The data archive is in transition from an off-line system (e.g., 6250 bpi tape) to a combined on-line and near-line system. The Marshall V0 DAAC near-line system is a Write Once Read Many (WORM) jukebox capable of archiving 1.2 TB of data. This system is connected to the DAAC computer, which is configured with 20 GB of on-line storage. The data holdings as of July 1994 are presented below and are summarized in Table 3.6. More detailed information is contained in Table A-6 of Appendix A.

Data Type	Volume (GB)	Data System	Remarks
SSM/I Antenna Temperatures	350	DAAC, WetNet	F8, F10, and F11 satellites from July 1987 through present in near real time (a few data gaps in early 1992). TOGA COARE subset available
SSM/I Pathfinder Products (Level-2 swath)	36	DAAC	Aug 1987–Nov 1988 for water vapor, cloud water, rain rate, land surface temperature, and type
MSU Temperatures with Limb90 correction	1	DAAC	Jan 1979–present for monthly gridded (2.5°) lower and middle tropospheric, and lower stratospheric temperatures and daily zonal lower stratospheric temperatures
MSU Pathfinder Path C1 Products	0.25	DAAC	April 1987–Nov 1988 for daily, pentad, and monthly gridded (1°) global lower tropospheric and lower stratospheric temperatures and oceanic precipitation
In situ Rainfall Observations	0.1	DAAC	Ship and surface stations, both regional and global

Table 3.6 MSFC DAAC—Summary of Data Holdings as of July 1994

3.6.1 SSM/I Data

The SSM/I temperature data archived at the Marshall V0 DAAC were generated to meet the requirements of the WetNet and SSM/I Pathfinder projects. WetNet initially received the SSM/I temperature data from Remote Sensing Systems (RSS). This data set was quality controlled by RSS and covers the period July 1987–December 1991 for the DMSP F8 satellite and January 1991–December 1991 for the DMSP F10 satellite. The early F8 data from RSS have been used by both projects.

In April 1992, MSFC began ingesting SSM/I data from the NESDIS. These data were processed by NESDIS using their Level-1B procedure. SSM/I data from the DMSP F8 and F11 satellites are archived since April 1992 and from the F10 satellite since June 1992. These NESDIS data sets are in the form of sensor counts and must be converted to brightness temperatures for scientific use. The data conversion is straightforward and the conversion utilities are provided by the MSFC DAAC. All SSM/I data are currently archived on 8 mm tape or WORM platters.

WetNet—The WetNet project is a 5-year pilot program (July 1990–July 1995) to study the use of distributed satellite data sets for hydrological research. The project has encouraged cooperative, interdisciplinary research by focusing on the use of SSM/I data for atmospheric, oceanic, and land process studies. The data are distributed to more than 40 science investigators representing NASA, other Federal agencies, universities, and international research organizations.

WetNet processes the NESDIS SSM/I data (F11 satellite) into brightness temperatures and stores them in McIDAS format. Data are distributed in near real time via electronic networks (using file transfer protocol, ftp, broadcasts) and magneto-optical disks. The ftp broadcast automatically sends daily global browse images (McIDAS format) to the scientists. Alternatively, any user may use ftp to acquire the browse data sets (McIDAS and GIF formats) or the full-resolution swaths from the DAAC ftp server. The magneto-optical disks contain the full-resolution footprint data sets and the reduced resolution global browse data sets. The magneto-optical data sets contain about 500 MB of data for a 2-week period and are mailed to users.

SSM/I Pathfinder—The SSM/I Pathfinder antenna temperature (T_a) data sets for the benchmark period (August 1987–November 1988) are available in HDF. The HDF data sets include the geolocations, antenna pattern correction, and all other metadata necessary to convert antenna temperatures to brightness temperatures. The processing of the derived geophysical products for the Benchmark Period was completed in June 1994. The geophysical algorithms are the Wentz atmospheric product suite of water vapor, cloud liquid water content, and marine wind speed, the Goddard Scattering Algorithm version 2 for rain rate, the Neale et al. land surface classification, the McFarland et al. land surface temperature, and the Cavalieri et al. sea-ice concentration. The MSFC SSM/I Pathfinder data sets will be primarily available on 8-mm tape. Electronic file transfer is possible although the large file sizes (11 MB to 45 Mb) may result in lengthy transmission times. The remainder of the SSM/I data (December 1988–present) will be processed after processing for the benchmark period is complete, following the recommendations of the SSM/I Pathfinder Science Working Group.

TOGA-COARE—A subset of the NESDIS Level-1B data set containing SSM/I data over the Tropical Ocean Global Atmosphere Coupled Ocean Atmospheric Response Experiment (TOGA-COARE) outer domain (30N–30S, 120E–160W) has been extracted for the period 1 November 1992–28 February 1993. These data are available via electronic file transfer or other media upon request. Software to convert to brightness temperatures or to further subset the data by geolocation is provided with every data order.

3.6.2 Microwave Sounding Unit (MSU) Data Sets

Several different data sets are generated by the Microwave Sounding Unit Pathfinder project. The data sets cover the period 1979–1993 and can be broadly categorized into deep layer average temperatures for the lower troposphere, the upper troposphere, the lower stratosphere, and oceanic rainfall estimates.

The NOAA satellites contributing to these data sets are TIROS-N, NOAA-6, -7, -9, -10, -11 and NOAA-12. NOAA-8 data were not used due to poor data quality. The data sets consist of grid point fields (1° or 2.5°) segregated by orbital pass (ascending or descending) and averaged over a day, a 5-day period, or a month.

At least two different limb correction processes have been used (Limb90 and Limb93) each with their own set of error characteristics. A complete description of the different processing procedures can be obtained by contacting the MSFC DAAC User Services Office.

3.7 National Snow and Ice Data Center (NSIDC)

The discipline focus of the Snow and Ice DAAC (SI DAAC) is on snow and ice processes, especially interactions between snow and ice and the atmosphere and ocean. The primary areas in which SI DAAC supports research are global change detection, Earth system model validation, and process model development and validation relating to the cryosphere.

Currently, snow and ice products are generated from DMSP SSM/I data. Non-satellite data, such as meteorological fields, station data, and buoy measurements, are archived for comparison to satellite information and for input into sea-ice and climate models. The SI DAAC supports the development of products to monitor ice-surface temperature and motion by providing access to 1 km AVHRR, DMSP OLS and SSM/T2, and TOVS satellite data. Satellite altimetry data are being archived and distributed to support ice-sheet topography studies.

As of July 1994, data sets held by the SI DAAC, include those of the heritage NSIDC Cryospheric Data Management System (CDMS). The suite of SI DAAC holdings is summarized in Table 3.7, with additional information provided in the following discussion and in Table A-7 of Appendix A. Note that Table A-7 includes some NOAA data sets for which there may be distribution restrictions. The distribution of these data and the prices to be charged will be governed by NOAA's policies and procedures. Access through the DAAC and the services to be provided by the DAAC are yet to be fully negotiated.

The paragraphs below contain a discussion of current data sets and the additional data sets that may be included in the SI DAAC in the future.

3.7.1 DMSP SSM/I Data

SI DAAC processes the SSM/I data into gridded, full global, and polar data products. All products are available on CD-ROM. Orbital data from the SSM/I instrument are held by NOAA Satellite Data Services Division (SDSD). Within the EOSDIS DAAC structure, the MSFC DAAC is designated as the Level-1.5 data archive. In the future, NSIDC may acquire SSM/I data from the National Geophysical Data Center Digital DMSP Data Archive (see Section 4.7).

Data Type	Volume (GB)	Remarks
DMSP SSM/I	70	Level-1.5 and Level-3 brightness temperatures; Level-3 ice extent and concentration (daily) and ice concentration (monthly)
Nimbus-7 SMMR	7	Level-3 brightness temperatures and sea-ice concentration
Geosat and Seasat altimetry data	15	Gridded elevations, height profiles, and wave form for Greenland and Antarctica
Nimbus-5 ESMR	3	Level-1.5 and Level-3 monthly and 3-day brightness temperatures and sea-ice concentration products (monthly)
AVHRR: Polar Subsets	120	Level-0 and swath data
LEADS: ARI	20	Level-3 AVHRR scenes
In situ data	1.9	Multiple source and data types

Table 3.7 NSIDC SI DAAC—Summary of Data Holdings as of July 1994

Products generated at SI DAAC from SSM/I data include gridded sea-ice concentration and brightness temperature. Currently, a polar stereographic projection covering the polar regions is employed. The Equal Area SSM/I Grid (EASE grid) will be produced in parallel with the polar stereographic products to provide improved radiometric fidelity, temporal resolution, and coverage.

3.7.2 Nimbus-7 SMMR Data

The SMMR on Nimbus-7 operated from 1978 to 1987. Current SI DAAC products include gridded SMMR brightness temperatures and sea ice concentration in the SSM/I polar-grid format, which were generated by Dr. Per Gloersen of GSFC in conjunction with the SI DAAC. The complete time series has been published on CD-ROM's.

3.7.3 AVHRR Data

Recent polar AVHRR data of both polar regions, at 1.1 km resolution (LAC and HRPT data types), are available from NSIDC. The Polar AVHRR 1-km Data Set at NSIDC consists of Antarctic scenes acquired since April 1992, and Arctic scenes acquired since August 1993. All five bands of the AVHRR sensor (primarily from the NOAA-11 satellite) are archived in orbit swath format, in uncalibrated sensor units. Several derived data products, such as sea ice motion and ice surface temperature, are under development in conjunction with the polar science community.

3.7.4 Radar Altimetry Data

SI DAAC distributes a data set derived from the Geosat and Seasat radar altimeters that contains georeferenced and corrected data collected over Greenland and Antarctica. The data are available as

either point elevations or interpolated onto a 20 km grid. NSIDC has arranged with NASA's GSFC to provide data distribution from its archive of Seasat and Geosat data (supervised by Dr. Jay Zwally of GSFC). Gridded digital elevations, height profiles, and waveform data are available for both missions. For requests of data over limited areas, NSIDC will select the data from the archive and deliver them (floppy diskette, tape, or ftp transfer). The entire data set, with browse and retrieval software, will be available on CD-ROM and will be distributed by both NASA GSFC and NSIDC.

3.7.5 Nimbus-5 ESMR Data

ESMR monthly and 3-day brightness temperatures and monthly sea ice concentration grids for 1973 to 1976 for Arctic and Antarctic regions are distributed on 9-track tape. Ancillary data include surface air temperature and pressure mapped to the same grid as the ESMR products.

3.7.6 In Situ Data

The following summarizes the more important in situ data available from the SI DAAC. A more complete list can be obtained from the SI DAAC Users Support Office.

Drifting Buoy Data—Arctic Ocean drifting buoy data (1979 to present) collected by the Polar Science Center (PSC), University of Washington, are archived at SI DAAC. This set of pressure, temperature, and interpolated ice-velocity values is derived from an average of about 10 Argos buoys per day. A related data set is the historical drifter data, also assembled by PSC and archived at NSIDC, containing 2-day interpolated velocities for 34 polar tracks spanning 1893 to 1973.

Arctic Sounding Data—The Historical Arctic Rawinsonde Archive (HARA) of Arctic temperature soundings above 65° N is archived at SI DAAC. Approximately 1.2 million soundings are contained in the archive, representing nearly 100 land stations. A smaller data set consisting of soundings from drifting ice stations, ships, and aircraft dropsondes will be available within several months. The daily sounding data base is available on three CD-ROM's.

3.7.7 Additional Data

NSIDC archives and supports polar subsets of satellite data that have primary archives at other DAACs or ADC's, as well as cryospherically relevant in situ data. This section presents the current status of these data sets. Satellite data sets are listed first, followed by in situ data sets.

DMSP OLS—NSIDC is in its 13th year of service as the national archive for visible and infrared imagery data from the U.S. Air Force DMSP Operational Linescan System (OLS). The archive contains over 1.5 million pieces of imagery in the form of hard copy films cataloged in an on-line data base.

The historical DMSP OLS imagery collection (with data from 1973 to the present), in the form of film positives, is being transferred to the National Archives and Records Administration Federal Records Center (NARA/FRC). The move to FRC has begun but will take several years. Regularly used data subsets, such as those for the polar regions, will be held at NSIDC until they are deemed no longer valuable.

AIDJEX—During the 1970's, the Arctic Ice Dynamics Joint Experiment (AIDJEX) generated data sets relating the response of sea ice to its environment. NSIDC holds three track-lines of sonar data collected in April 1976, containing a 777-nautical-mile profile of the sea ice. Wind, current, and position data from four manned camps on ice floes are also held for April–October 1975. The location of most of the AIDJEX data sets is unknown at this time. NSIDC continues to seek out information that may lead to the recovery of these data.

MIZEX—The Marginal Ice Zone Experiment (MIZEX), which was conducted in the Fram Strait and Greenland Sea in June to July 1983, May to July 1984, and March to April 1987, and in the Bering Sea in February 1983, provided data from shipborne platforms on processes in the marginal ice zone. Supporting data sets on meteorology, oceanography, sea-ice conditions, and biology are archived at NSIDC. Meteorology data are distributed on the CEAREX Vol. 1 CD-ROM.

CEAREX—The Coordinated Eastern Arctic Experiment (CEAREX), carried out in the East Greenland Sea west of Svalbard from September 1988–June 1989, used satellite-, ship-, aircraft-, helicopter-, and ice-floe-based sensors. Surface platforms provided meteorological, oceanographic, biological, acoustic, and sea-ice data. NSIDC is the designated archive for the CEAREX data sets, and is funded by ONR to generate a CD-ROM series containing CEAREX and other important eastern Arctic data (Volume 1 released in November 1991).

Birdseye Data—NSIDC holds over 11,000 ice observations from U.S. Navy “Birdseye” and other ice reconnaissance operations spanning 1964 to 1975. Airborne sensors flown during MIZEX and CEAREX also generated SAR and SLAR data; microwave, infrared, and visible imagery; radar altimetry; and boundary-layer meteorology. If funded, these data sets will be available for incorporation in the eastern Arctic CD-ROM series, and are an invaluable resource for better understanding the meso- to small-scale processes in the exchange of momentum, heat, and biomass within ocean eddies, internal waves, and the ocean/atmosphere boundary layer.

3.8 Oak Ridge National Laboratory (ORNL)

The ORNL DAAC draws on the experience gained from previous data management systems, including the International Biome Program (IBP), the Atmospheric Radiation Measurement (ARM) Archive, and the Carbon Dioxide Information Analysis Center (CDIAC), a World Data Center–A (WDC–A) for Atmospheric Trace Gases.

Current holdings of the ORNL DAAC include data from FIFE, the Oregon Transect Ecosystem Research (OTTER) Project, and other projects formerly maintained in NASA's PLDS. Many of the

Numerical Data Packages (NDP's) and Computer Model Packages (CMP's) created and held by CDIAC are also available through the ORNL DAAC.

Data sets held by the ORNL DAAC as of June 1994 are summarized in Table 3.8, with additional detail contained in the following discussion and Table A–8 of Appendix A.

Data Type	Volume (GB)	Date Available	Remarks
FIFE	0.15	1994	Ground measurements and remotely sensed data from comprehensive study of radiation, moisture, and CO ₂ fluxes on Konza Prairie ecosystem in Kansas, USA, in 1987 and 1989.
OTTER	15.15	1994	Ground measurements and remotely sensed data from comparative study of carbon, nitrogen, and water fluxes in coastal, western-Cascades, and eastern-Cascades forests of Oregon, USA, 1988–1991.
CDIAC	0.50	1994	Numerous data packages including atmospheric concentrations of methane and carbon dioxide; estimates of global, national, and regional CO ₂ emissions; long-term temperature records; historical data from ice cores; data for chloroflourocarbons and other trace gases; and other data sets and computer models held by the ORNL Carbon Dioxide Information Analysis Center.

Table 3.8 ORNL DAAC—Summary of Data Holdings as of July 1994

3.8.1 First ISLSCP Field Experiment (FIFE)

The First ISLSCP Field Experiment (FIFE) was initiated in 1984 to conduct a multiscale, interdisciplinary field experiment dedicated to observation, analysis, and modeling of soil–plant–atmosphere interactions. The experiment was centered on a 15 x 15 km grassland site on the Konza Prairie of Kansas. Satellite, meteorological, biophysical, and hydrological data were collected from early 1987 through October 1989. Fluxes of heat, moisture, carbon dioxide, and radiation were measured with surface and airborne equipment. These observations were coordinated with measurements of surface and atmospheric parameters and satellite overpasses during a series of 12- to 20-day intensive field campaigns (four in 1987 and one in 1989).

FIFE data include AVHRR, Landsat, SPOT, and GOES satellite data; meteorological data from 16 automated meteorological stations within the site; gravimetric soil moisture surveys; streamflow data and biometric measurements; and observations of relevant atmospheric optical properties. Three aircraft (NASA C–130, NASA helicopter, and NOAA Aerocommander) took radiometric measurements using a variety of scanners, radiometers, and scatterometers operating over the visible, near-infrared, thermal, and microwave wavelength intervals. Three other aircraft (Canadian Twin Otter, National Center for Atmospheric Research KingAir, and University of Wyoming KingAir) took flux measurements of heat, moisture, momentum, and carbon dioxide (Twin Otter only) fluxes over

the site. These activities were closely coordinated with each other and with satellite overpasses. In total, some 180 missions and over 400 flight hours of aircraft flight time were dedicated to data acquisition during FIFE.

The purpose of the OTTER project was to estimate major fluxes of carbon, nitrogen, and water of forest ecosystems using an ecosystem process model driven by remotely sensed data. Study sites included a coastal forest of western hemlock, sitka spruce, and red alder in a recent clearcut; a mid-elevation forest of Douglas fir in the lower Cascades and a fertilized plot nearby; and an inland forest of ponderosa pine on the drier eastern slope of the Cascades with an irrigated and fertilized forest nearby. OTTER data sets include canopy chemistry, meteorology, field sunphotometer, airborne sunphotometer, and timber measurements. The data are currently available through the ORNL DAAC on a CD-ROM published at ARC in 1990 as well as in the ORNL DAAC on-line information system. The CD-ROM contains all the field data, remotely sensed data, and image data files as they existed at the time of publication.

Many of the data sets held at the CDIAC, located within the Environmental Sciences Division of ORNL, are available through the ORNL DAAC. Some of CDIAC's more commonly requested data sets include Atmospheric CO₂ Concentrations at Mauna Loa Observatory, United States Historical Climatology Network (HCN) Temperature and Precipitation, An Updated Global Grid Point Surface–Air-Temperature Anomaly (1851–1990), Estimates of CO₂ Emissions from Fossil Fuel Burning and Cement, and the IEA/ORAU Long-Term Energy–CO₂ Model.

3.9 Socioeconomic Data and Applications Center (SEDAC)

SEDAC operates within EOSDIS as a bridge between the social and natural sciences. Its responsibility is to develop policy-oriented applications products that synthesize Earth science and socioeconomic data. This applications development is intended to support the public policy analysis and policy making community. SEDAC will develop and operate a directory capability—interoperable with the Global Change Master Directory and EOSDIS—that provides the socioeconomic community with information about Earth science data products, and the Earth science community with information about socioeconomic data. To reach this end, SEDAC will archive and distribute the data directly, or will make the data available through cooperative agreements with other data providers.

Currently, all data in the CIESIN archive are available without restriction. Data sets available as of July 1994 are presented below and are summarized in Table 3.9.

3.9.1 SEDAC Data

These data sets are held in the SEDAC as of July 1994:

National Economic, Social and Environmental Data Bank—This data set from the Department of Commerce provides information on Government resources available to businesses and includes rules and regulations that may affect them. It is designed to support Government policy makers and the public concerned with issues relating to the U.S. economy, society, and the environment.

The United Nations Conference on Environment and Development Collection—This collection consists of documents preparatory to and generated by the conference, held from June 3 through June 14, 1992, in Rio de Janeiro, Brazil.

County Business Patterns—*County Business Patterns* is an annual series of reports by the Bureau of the Census providing detailed information on United States business and industries. Each report presents statistics on State- and county-level mid-March employment, first quarter and annual payrolls, total number of establishments, and total number of establishments by employment-size class for all establishments with one or more paid employee.

USA Counties: A Statistical Abstract Supplement—This data set contains demographic, economic and governmental data taken from Census Bureau statistics given at the county level for the United States. The data are presented to allow multicounty comparisons or single-county profiles.

Public Use Microdata Samples—PUMS are computer-accessible files containing United States census records for a sample of housing units, with information on the characteristics of each housing unit and the people in it. Each PUMS file provides records for States and many of their geographic levels.

March Current Population Survey Data, 1968–1992—This survey, conducted by the Bureau of the Census, is an annual demographic survey of the civilian, noninstitutionalized population of the U.S.

Environmental Subset of Collection of Multilateral Conventions at the Fletcher School of Law and Diplomacy—This includes the text of selected international treaties and agreements important to the environment. The set was chosen from a collection electronically scanned by the Fletcher School of Law and Diplomacy, primarily from the United Nations Treaty Series.

Economic Census—The Economic Censuses, conducted every 5 years by the Bureau of the Census, provide information on the structure and functioning of the United States economy. The Censuses present a complete, detailed picture of the economic sectors covered from the national to the local level, encompassing approximately 12.4 million establishments. Information is collected using mail questionnaires and data from the administrative records of other Government agencies.

Data Type	Volume (GB)	Data System	Remarks
National Economic, Social and Environmental Data Bank	.240	CIESIN	Information on Government resources available to businesses.
The UN Conference on Environment and Development Collection	.016	CIESIN	Documents generated by the conference.
County Business Patterns	.382	CIESIN	Detailed information on United States business and industries.
USA Counties: A Statistical Abstract Supplement	.087	CIESIN	Demographic, economic, and governmental data taken from Census Bureau statistics.
Public Use Microdata Samples	1.403	CIESIN	United States census records for a sample of housing units.
March Current Population Survey Data, 1968–1992	.308	CIESIN	Demographic survey of the civilian, non-institutionalized population of the United States.
Environmental Subset of Collection of Multilateral Conventions at the Fletcher School of Law Diplomacy	.001	CIESIN	Text of selected international treaties and agreements important to the environment.
Economic Census	.347	CIESIN	Information on the structure and functioning of the United States economy.
County and City Data Book, 1988	.011	CIESIN	Demographic, economic, and governmental data.
Regional Economic Information System	.492	CIESIN	Economic data and annual estimates of personal income.
Register of International Treaties	.001	CIESIN	Information on environmental treaties agreements.
Hazardous Substance Release/Health Effects Data base (HazDat)	<0.001	CIESIN	Information on the release of hazardous substances.

Table 3.9 SEDAC—Summary of Data Holdings as of July 1994

County and City Data Book, 1988—From the Bureau of the Census, this report provides demographic, economic, and governmental data taken from both the Federal Government and private agencies. Tables include data from current estimates, population and housing census, and economic censuses. It contains statistics on agriculture; area and population; banking; climate; crimes; education; elections; electric bills; Government finances and employment; health; households; housing; income; manufactures; retail and wholesale trade; service industries; and vital statistics.

Regional Economic Information System—Provided by the Bureau of Economic Analysis (BEA), this compilation contains economic data and annual estimates of personal income for the residents of the United States as well as individual States for 1969–1989. Statistics include personal income by source; per capita personal income; earnings by two-digit Standard Industrial Classification (SIC) code industry; full and part-time employment by industry; regional economic profiles.

Register of International Treaties—This compilation by the United Nations Environment Programme (UNEP) includes an introduction and index plus information on environmental treaties and agreements. These summaries cover agreements relevant to international environmental issues since 1921.

3.9.2 SEDAC Linkages

The Hazardous Substance Release/Health Effects Database (HazDat) is available through SEDAC by electronic linkage. HazDat was developed by the Agency for Toxic Substances and Disease Registry to provide access to information on the release of hazardous substances from Superfund sites or from emergency events and on the effects of hazardous substances on the health of human populations. Information included are site characteristics, activities and site events, contaminants found, contaminant media and maximum concentration levels, impact on population, community health concerns, ATSDR public health threat categorization, ATSDR recommendations, environmental fate of hazardous substances, exposure routes, and physical hazards at the site/event.

4.0 Projected July 1998 DAAC Science Data Holdings

This chapter presents a summary of the science data sets expected to be supported by the DAACs at the end of FY98. The tables in this chapter do not include any analog data. Where appropriate, the disposition of analog data is considered. This chapter does include a discussion of some additional data activities that were not considered in Section 2, primarily ongoing efforts to generate new products from existing data. Additional details on required data activities and schedules are presented in Section 2.

CIESIN's SEDAC is in the process of establishing an archive of data and has identified the types of data and the initial data sets to be supported. While SEDAC is still in the process of determining additional data sets to be directly archived in its facility, this chapter does include a discussion of the initial data sets and the types of data to be held at CIESIN.

4.1 Alaska SAR Facility

The projected data holdings of the ASF DAAC as of July 1998 are summarized in Table 4.1 and discussed below, with additional detail in Table A-1 of Appendix A.

Data Type	Volume (GB)	Date Avail.	Remarks
ERS-1 SAR Signal Data	34,400	Jan 92	Raw data; distribution restrictions apply
JERS-1 SAR Signal Data	13,800	Mar 93	Raw data; distribution restrictions apply
ERS-1 Level-1 Data	11,288	Jan 92	Level-1 data; distribution restrictions apply
JERS-1 Level-1 Data	3,253	Mar 93	Level-1 data; distribution restrictions apply
ERS-1 + JERS-1 Geolocated Data and Geophysical Parameters	275	1991	Geophysical products will be generated first from ERS-1 data; combined product when JERS-1 data are available; distribution restrictions apply
ERS-2	TBD	1995	launch in 1995
Radarsat	TBD	1995	launch in 1995
AVHRR—Digital Data	TBD	TBD	AVHRR HRPT data

Table 4.1 ASF DAAC—Summary of Projected July 1998 Data Holdings

Collection of ERS-1 and JERS-1 data will continue with anticipated successor satellites (e.g., ERS-2). Distribution restrictions are expected to continue on ERS and JERS-1 data. AVHRR data acquisition is expected to continue. Plans are being made to upgrade the AVHRR archive at ASF with a larger flow of HRPT data to be received from a station located at the Geophysical Institute. The conversion to an all-digital archive is anticipated. Several options to improve near-real-time capabilities plus access to a fully populated archive are under study at this time.

Two satellites, ERS-2 and Radarsat, will be launched in the first quarter of calendar year 1995. Full data access to ERS-2 is likely by June 1995. Radarsat global data access is likely to begin in the fall of 1995. See Section 3.1 for a discussion of the data access policy for these International Partner missions.

It is expected that the GeoData Center will continue to support the analog AVHRR and Landsat archives. Whether and how this activity will be coordinated with this DAAC is to be determined.

4.2 EROS Data Center

All data and products available from the EDC DAAC will continue to be available through 1998, with the size of many collections increasing significantly. New data and data products are also anticipated to be available from the EDC DAAC. The projected 1998 data holdings are summarized in Table 4.2 and in the following paragraphs, with additional detail provided in Table A-2 of Appendix A.

Data Type	Volume (GB)	Date Avail.	Remarks
Landsat MSS and TM	750	Current and TBD	Includes NASA Global Change Landsat Data Collection data (currently available) and Landsat Pathfinder Level-2 and higher products (TBD). Distribution restrictions apply to some data.
AVHRR LAC and HRPT	3,800	Beginning 7/94	Global 10-day Vegetation Composites and Daily 1-km Orbital Segments.
Airborne Scanner Data	450	Current and TBD	TIMS data are currently available. Other data sets not currently available include NS-001, TMS, and AVIRIS.
DEM Data	40	Current and TBD	DEM derived from a variety of sources. Some gridded DEM from DCW currently available.
SAR Data	180	Beginning 10/94	SIR C data are expected to be available in October 1994, additional data sets are being studied.
NDVI	100	Current	Global.

Table 4.2 EDC DAAC—Summary of Projected July 1998 Data Holdings

Landsat MSS and TM—More than 500 scenes of TM data are currently available as part of the NASA Global Change Landsat Data Collection. Additional scenes have been identified and are planned to be acquired. Copyright restrictions apply to these data. Beginning in 1994, a number of data sets resulting from the Landsat Pathfinder program will become available. These include MSS and TM Level-2 “consistent P” products generated for use by the Humid Tropical Forest Project and MSS multitemporal “triplicates” generated for use by the EPA North American Landscape Characterization Project. Future Landsat Pathfinder plans also include the preparation of multitemporal TM, MSS, and AVHRR data collections for selected EOS land cover test sites as part of the Global Land Cover Test Sites Project.

Synthetic Aperture Radar (SAR) Data—Current plans call for the EDC DAAC to archive and distribute SIR-C data beginning in October 1994. In addition, plans also include the transfer of SIR-B, Seasat, and AIRSAR processed image data from JPL to EDC in FY 1994 for archive and distribution. The feasibility of the EDC DAAC archiving and distributing selected foreign satellite SAR data is also being investigated. At this time, it is not clear which, if any, additional SAR data will be supported by the EDC DAAC.

Global 1 km AVHRR Data—The EDC DAAC is generating 10-day Global Vegetation Composites beginning with the April 1–10, 1992, time period. By 1995, it is planned that 18 months of data (i.e., 54 10-day composites) will have been generated and archived for distribution by the EDC DAAC. As a byproduct of the composite product generation process, daily orbital segments are being constructed and made available by the DAAC.

Airborne Scanner Data—EDC is continuing efforts to archive and distribute data from several NASA airborne sensors. The EDC DAAC is currently transcribing and archiving TIMS data from ARC and the Stennis Space Center. TIMS data will initially become available from the DAAC in July 1994. By the end of 1995, the DAAC also expects to develop capabilities and assume responsibilities for archiving, processing, and distributing much of the AVIRIS data acquired by NASA and presently available from JPL. The EDC DAAC is also investigating the potential transfer of ASAS data from GSFC.

Digital Elevation Model (DEM) Data—The EDC DAAC, in cooperation with the USGS and other agencies, is generating raster DEM products derived from DMA’s 1:1,000,000 scale Digital Chart of the World, which is composed of all fully structured data captured from global 1:1,000,000 scale Operational Navigational Charts (ONC), including elevation contours, surface drainage, and greenness. These products will be available from the EDC DAAC beginning with the African DCW DEM in May 1994.

The EDC DAAC may generate, archive, and distribute regional and continental 0.5 km DEM’s compiled from DTED and other existing data. EDC expects to generate, at least experimentally, higher resolution local DEM’s from airborne photographic and satellite image data sources. The overall scope of this effort is yet to be determined.

Additional Data and Products—Additional data sets of relevance to pre-EOS science investigations that may be available from the EDC DAAC by 1998 include global soils data, global vegetation-cover products, hydrologic data, and derivative topographic products such as slope.

4.3 Goddard Space Flight Center

By July 1998, the current GSFC science data holdings to be supported by the Goddard DAAC will have increased significantly. The projected data holdings are summarized in Table 4.3, while Table A–3 of Appendix A provides a more detailed description. While it is anticipated that some of the current GSFC data holdings will move, the volumes and data set listings in Table 4.3 and Table A–3 do not reflect this. These figures will be revised when transition plans are final.

Current holdings will continue to be supported in FY98. New data sets will be added and several existing data sets will have grown substantially in volume, most notably the AVHRR and TOVS Pathfinder data. Specific data products to be added to the Goddard DAAC holdings during the Version 0 EOSDIS time frame include all levels of SeaWiFS data, several follow-on TOMS data sets, UARS Level-2 data products, and the long-term record of NOAA Level-1B input data used in the Pathfinder processing. In addition, the GSFC DAAC will have begun receiving data from the TRMM Earth probe mission in late FY97 as well as from the MODIS instrument scheduled to be flown aboard AM–1, the first of the EOS-era platforms to be launched in 1998.

SeaWiFS Data—During FY94, the Goddard DAAC will prepare for the receipt of SeaWiFS data, which is due to begin in the third quarter of FY95. SeaWiFS data products will include pigment concentrations and imagery at several spatial and temporal resolutions. Archived data will include Level-1 and Level-2 GAC, Level-1 LAC, Level-1 HRPT from five U.S. coastal stations, and Level-3 binned and mapped products, all in the HDF format. Because of the agreement with Orbital Sciences Corporation, SeaWiFS data will be subject to distribution restrictions for 5 years after observation. While metadata will be accessible to all, SeaWiFS data products will be distributed to authorized users only. For additional information on access to these data, contact the SeaWiFS Project Office.

UARS Data—Data available from UARS includes the full complement of Level-3A products from the suite of nine atmospheric and solar instruments used for the study of upper atmosphere chemistry and dynamics. This suite may also include the Level-3B products for the CLAES, ISAMS, MLS, HRDI, and WINDII instruments, which represent the daily data as a set of Fourier coefficients and associated error covariance matrix mapped to a standard latitude and pressure grid. In addition, for those instruments for which a Level-3 mapping is not necessarily the optimal representation, as in the case of occultation experiments such as HALOE or energy deposition data from PEM, the Level-2 data will be archived along with the corresponding Level-3 product. The long-term archive for UARS low-level (0–1) products is still being negotiated between NASA and NOAA.

Data Type	Volume (GB)	Date Avail.	Remarks
Atmosphere, Climate	32	Current	Primarily data from GEDEX CD-ROM and Nimbus-7 SBUV, LIMS
CZCS	757	Current	Levels 1–3 products; possibly a reprocessing
SeaWiFS Data	3363	1994	Levels 1–3 products and ancillary data
UARS Data	214	Current	Level-2 through Level-3 products
TOMS Data	71	1995	Levels 2–3 products from N7, M3, Earth Probes and ADEOS; all in common format
NOAA AVHRR Data	1,822	TBD	Raw GAC data (to 1992) received from NOAA, backup archive
AVHRR Pathfinder	165+	Current	Level-3 land products; possible inclusion of 1993–1998
4-D Assimilated Data	150	Current	Time Series Subset
4-D Assimilated Data	700	late CY94	Complete data set
TOGA–COARE	130	1995	NASA-funded experiments
NOAA TOVS Data	615	8/94	Raw data as received from NOAA and reformatted by NCAR
TOVS Pathfinder	3011	10/94	Raw data and Levels 2–4 products for 1978–1994
TRMM	TBD	1997	VIRS instrument data
MODIS	TBD	1998	Builds on capabilities of AVHRR, CZCS, Landsat TM, and HIRS instruments

Table 4.3 GSFC DAAC—Summary of Projected July 1998 Data Holdings

TOMS Data—TOMS data products will continue to be archived at the GSFC DAAC as new Earth Probes and alternate platforms (e.g., ADEOS) are launched in the EOS era. It is expected that both the Level-2 and Level-3 products will be generated using a common HDF implementation to facilitate intercomparison with data from previous TOMS instruments. In addition, reprocessing of older data sets from Nimbus-7 and Meteor-3 will continue to be supported as improved and internally consistent calibration techniques become available.

Pathfinder Data—The AVHRR Pathfinder products will provide a 12-year record of land (NDVI and channel radiances) products processed in a consistent manner and using the best available thermal and visible calibration techniques. The TOVS Pathfinder products will provide atmosphere, surface, and cloud parameters derived on a global scale for the 15-year period beginning with the launch of TIROS-N (1978). By October 1994, the GSFC DAAC will have assumed operational processing responsibility for both the AVHRR Land and TOVS Pathfinders. Upon completion of the processing for the baseline Pathfinder period, and pending approval from NASA Headquarters, the DAAC may continue to process subsequent data from the years 1993 onward using these same algorithms. This

additional data volume is not reflected in the Table 4.3. It is also anticipated that the Level-1B GAC and Level-1B TOVS input data will have been ingested and archived in the DAAC near-line mass storage system by this time.

4-D Assimilation Data—The 4-D Assimilation data set consisting of a 150 GByte subset of geophysical parameters in time series format will have been completely archived by early FY95. The full complement of data from 1985–1989 amounts to about 700 GBytes, and the GSFC DAAC is preparing to archive these data, plus any additional data resulting from processing beyond 1989.

TRMM Data—The GSFC DAAC will be responsible for archive and distribution of the data products from the VIRS instrument. Products will include the Levels 1A and 1B radiance data, and Level-2 rain rates and rain types derived both at the VIRS sampling resolution and over coarser spatial and temporal scales. In addition, data from VIRS, TMI, and PR will be used to derive Level-3 maps of surface rainfall rates and profiles of hydrometeors and heating at 15 levels in the troposphere and at various temporal and spatial resolutions. All products will be generated and quality assured by the TRMM Science and Data Information System (TSDIS), located at GSFC, prior to transfer to the Goddard DAAC.

MODIS Data—The MODIS instrument aboard the EOS AM platform will provide imagery with a spatial resolution of 250 m to 1 km in 36 discrete visible and IR bands for use in studies related to biological and physical processes occurring on the surface of Earth and in the lower atmosphere. The GSFC DAAC will be responsible for the end-to-end processing, archive, and distribution of MODIS global survey data products, including surface temperature, ocean color, chlorophyll concentration and fluorescence, surface vegetation and snow cover characteristics, and cloud and aerosol properties. A full listing of the derived geophysical parameters from the MODIS instrument is given in Table A3 of Appendix A.

Other Data—Archiving responsibility for some data sets of historical importance previously supported by NSSDC will have been transferred and integrated into the DAAC by this time frame. These include the Level-1 and Level-2 Nimbus-7 SBUV data sets and as well as the 8-month record of Level-2 and Level-3 data products from the LIMS instrument, which served as a precursor to the UARS mission. Some historical data sets for which the user community no longer has need (primarily Level-0 and Level-1 data) will be moved to long-term archives such as the Federal Records Center (FRC).

Data supported by the Goddard DAAC will be archive-quality products developed from the best available algorithms and be subject to internal quality control procedures. Experimental data sets that may be distributed will be clearly marked as experimental or investigator products. For all data distributed by the Goddard DAAC, documentation will describe the details of the data production sequence, including algorithms and quality control procedures used.

4.4 Jet Propulsion Laboratory

A summary of the expected data holdings as of July 1998 is presented in Table 4.4, with additional information contained in Table A-4 of Appendix A and the following paragraphs.

The JPL DAAC will provide ongoing acquisition, archiving, and distribution of satellite oceanographic data products from pre-EOS missions. In particular, the JPL DAAC will be responsible for archiving and distributing data from the TOPEX/Poseidon mission, and for packaging, archiving, and distributing data from the NSCAT/ADEOS mission. Data products will be archived and distributed in formats to be determined by the JPL DAAC UWG.

Data Type	Volume (GB)	Date Avail.	Remarks
Existing Data Products	130.2	Current	1998 volume of data and geophysical products in current JPL archive
TOGA CD-ROM	6	Current	In situ data on CD-ROM
TOPEX/Poseidon Data	376.3	Current	Altimeter all Levels, TMR Level-1
AVHRR Pathfinder Ocean Products	6,800	1994	AVHRR Pathfinder ocean products
Geosat Products	7	Current	Ocean height, wind speed, buoy data
SMMR Data and Products	0.6	Current	Brightness temperature, heat fluxes, wind speed, and water vapor
Altimetry CD-ROM	7	10/94	Combined GEOS-3, Seasat, Geosat, ERS-1
Scatterometry Standard Data Products	963.6	8/96	Level-1.0, 1.5, 1.7, 2.0, 3.0
NOAA AVHRR Data	1822	1994	Raw data as received from NOAA, backup archive

Table 4.4 JPL DAAC—Summary of Projected July 1998 Data Holdings

In 1998, data from the ERS-1 Scatterometer will be distributed only to the U.S. investigator teams. Data acquisition may be underway for the TOPEX/Poseidon mission, and the merged GDR will be a standard product. The JPL DAAC will archive the NASA Altimeter SDR, GDR, TMR SDR, and merged TOPEX and Poseidon GDR (see Section 2.5.4), together with ancillary data from the TOPEX/Poseidon mission.

The JPL DAAC plans to generate several new data products from current data. These data sets and activities are described in the following paragraphs, with the anticipated dates of availability indicated. Details are described in the *Physical Oceanography DAAC Science Support Plan*, JPL Document D-9247, June 1994. See Section 2 for additional discussion on the Pathfinder, Earth Probes, and International Partner data sets to be supported by the JPL DAAC.

The sea-surface temperature and buoy match-up data sets generated by the AVHRR Pathfinder activity will be archived and distributed by the JPL DAAC for use by the oceanographic community. The Nimbus-7 spacecraft carried an SMMR for measuring atmospheric and ocean surface properties. The Nimbus-7 SMMR brightness temperatures, reprocessed with a consistent calibration, as a joint effort between JPL and GSFC, will be available at the end of FY94

JPL plans to generate CD-ROM sets of the TOGA in situ data for the duration of the TOGA Program (1985–1995). This task is based on a pilot study, funded by NODS, for the JPL DAAC to generate a CD-ROM containing the 1985–1986 data sets. The project will be completed in 1997 with coverage for the 10 years of the TOGA program. The data volume is approximately 10 CD-ROM's, one per year, at 680 MB per CD, for 6.8 GB.

An enhanced altimetry data set will be assembled on CD-ROM's; the set will include data from the ERS-1 Altimeter, enhanced with more precise orbit and tidal models. The data volume is approximately 10 CD-ROM volumes, one per year, at 680 MB per CD, for 6.8 GB. This data set will be available beginning in November 1994.

4.5 Langley Research Center

In 1998, the Langley DAAC will perform data management, archival, and distribution functions for the general science community in the areas of radiation budget, clouds, aerosols, and tropospheric chemistry. Major data sets identified for service include Earth radiation budget data from ERBE; selected Nimbus-6 and Nimbus-7 ERB data; aerosol and trace gas data from SAM II, SAGE I and SAGE II; ISCCP data; Surface Radiation Budget (SRB) data; field experiment data from the FIRE and GTE programs; tropospheric carbon monoxide data from the MAPS shuttle missions; solar data from several satellite experiments; CERES data from TRMM; and initial data from the CERES, MISR, and MOPITT experiments on the EOS AM platform. Higher level products from the GOES Pathfinder activity, products from the AVHRR Atmosphere Pathfinder, and data from aircraft flights of the TES-prototype instrument AES may also be included. The Langley DAAC will continue to provide needed processing for SRB and ERBE data.

Areas in which data will be held are outlined in the following paragraphs. Anticipated data holdings are summarized in Table 4.5, and more detailed information is provided in Table A-5 of Appendix A.

ERBE Data—The Langley DAAC will continue to be the active archive for ERBE data. Processing of ERBE data will continue as long as the non-scanner instrument remains active. Principal changes from the present status will include the addition of more granules to current data sets and the addition of new nonscanner products.

SAM II, SAGE I, and SAGE II Data—The Langley DAAC will continue to be the active archive for SAM II, SAGE I, and SAGE II data. Processing of SAGE II data will continue as long as the satellite remains active. Principal changes from the present status will include the incorporation of additional products and updating current holdings.

Data Type	Volume (GB)	Date Avail.	Remarks
ERBE Level-0	277+TBD	Current	Data from ERBS, NOAA-9, -10; ongoing
ERBE Products	149+TBD	Current	Processed ERBE Data
SAM II and SAGE I and II Level-0	76+TBD	Current	Data from Nimbus-7, AEM-2, ERBS; ERBS ongoing
SAM II and SAGE Products	36+TBD	Current	Radiances and profiles SAGE II; ongoing
ISCCP	877	Current	Cloud analysis data; ongoing
Surface Radiation	1	Current	SRB data sets; ongoing
ERB Products	TBD	1994	Transfer from NSSDC
FIRE Data	321+TBD	Current	Ongoing for new field experiment data
GTE Data	4+TBD	Current	Existing and new field experiment data
EOS Data	10770 +TBD	1997/1998	
Additional data	TBD	ongoing	MAPS, GOES Pathfinder, Tropospheric Ozone, Spectroscopy

Table 4.5 LaRC DAAC—Summary of Projected July 1998 Data Holdings

ISCCP Data—The Langley DAAC will continue to be the active archive for ISCCP data. Emphasis will be on the ISCCP D1, D2, and DX products with continued support of the Stage B3, Stage C1, and Stage C2 products. Principal changes from the present status will include incorporation of additional products and updating current holdings.

Surface Radiation Budget (SRB) Data—The Langley DAAC will continue to be the active archive for SRB data. The principal change from the present status will be the incorporation of new products as they are developed.

ERB Data—The Langley DAAC will be the active archive for specific Nimbus-6 and Nimbus-7 ERB data identified for service. The principal change from the present status will be the transfer of the data from other data centers to the Langley DAAC for archive and distribution.

FIRE Data—The Langley DAAC will continue to be the active archive for data from the FIRE field experiments. The principal change from the present status will be the updating of current holdings.

GTE Data—The Langley DAAC will continue to be the active archive for tropospheric chemistry data from selected GTE field experiments. The principal changes from the present status will include supplementing current data sets and transferring additional data.

CERES Data—Data from the CERES instruments (launched on TRMM in August 1997 and EOS AM-1 in June 1998) will be processed, archived, and distributed by the Langley DAAC as an EOSDIS

activity. These instruments will continue the long-term measurement of the Earth radiation budget and provide continuity with ERBE measurements.

MISR Data—Data from the MISR instrument will be processed, archived, and distributed by the Langley DAAC starting with the launch of EOS AM-1 in June 1998. MISR provides top-of-atmosphere radiance, cloud and surface angular reflectance functions, and provides global maps of the planetary and surface albedo, aerosol, and vegetation properties.

MOPITT Data—Data from the MOPITT instrument will be processed, archived, and distributed by the Langley DAAC starting with the launch of EOS AM-1 in June 1998. MOPITT will measure emitted and reflected infrared radiation in the atmospheric column which, when analyzed, permits retrieval of tropospheric CO profiles and total column CH₄.

Other Data—Several other data sets have been identified for archive in the Langley DAAC by 1998. These include the tropospheric carbon monoxide data from MAPS shuttle missions, solar data from satellite experiments such as ACRIM and SME; a derived data set on tropospheric ozone generated from satellite data; and key atmospheric spectroscopy data. In addition, Langley DAAC holdings may also include data from the GOES Pathfinder, the AVHRR Atmosphere Pathfinder, and aircraft flight data from the Atmospheric Emission Spectrometer (AES).

4.6 Marshall Space Flight Center

The 1998 anticipated Marshall DAAC data holdings are discussed below and summarized in Table 4.6, with additional details in Table A-6 of Appendix A.

SSM/I Data—The Marshall V0 DAAC ingests, processes, and archives SSM/I data from all working DMSP satellites. At present, the data for the DMSP F8, F10, and F11 satellites are received daily at MSFC through a V0 network link with NOAA/NESDIS. The F12 satellite has an expected launch date in fall 1994. A special TOGA/COARE project data set has been subsetted for both the Inner and Outer TOGA/COARE regions. These are available for the November 1992–February 1993 time period.

SSM/I Pathfinder data sets are being processed at both the Marshall and NSIDC DAACs. The MSFC component of the SSM/I pathfinder is focused on the swath (satellite field of view) data sets, while NSIDC is processing the SSM/I data into equal area grids. The benchmark phase (August 1987–November 1988) of the MSFC Pathfinder effort is completed. The SSM/I Pathfinder geophysical products (water vapor, cloud liquid water content, precipitation, marine wind speed, land classification and temperature, and sea-ice age and concentration) have been produced. The MSFC DAAC distributes water vapor, cloud liquid water, precipitation, land surface temperature and type. The marine wind speed product is available through the JPL DAAC while the NSIDC DAAC archives the sea ice products.

Data Type	Volume (GB)	Date Avail.	Remarks
SSM/I antenna temperature and products	450	Current, Ongoing	F8, F10, F11, and F12 satellites. Atmospheric moisture, land surface type, precipitation
MSU atmospheric temperatures and ocean precipitation	2.5	Current, Ongoing	Multiple NOAA satellites 1979–1994. Lower troposphere, upper troposphere and lower stratosphere gridded temperatures
SSM/T, /T2 temperature and water vapor profiles	TBD	1994	F11 and F12 satellites
SMMR brightness temperatures	54	1994	Reprocessed for SMMR Pathfinder
MSU brightness temperature and products	33.8	Current, Ongoing	Multiple satellites 1979–1994 and derived products
Lightning data	17	Current, Ongoing	Continental U.S. network, OLS, and Optical Transient Detector (OTD)
Surface streamflow	1	Current	Hydroclimatology data sets from precipitation and stream flows
Satellite-derived rainfall climatology	.01	Current	Data sets derived from infrared and passive microwave observations
In situ rainfall observations	0.1	Current	Ships and surface stations, global and regional coverage
Surface radar rainfall composites	17	Current, Ongoing	Derived from National Weather Service radar
AMPR aircraft data	0.5	1994	Passive microwave instrument flown in CaPE and TOGA field experiments

Table 4.6 MSFC DAAC—Summary of Projected July 1998 Data Holdings

MSU Data—Atmospheric temperatures and oceanic precipitation have been derived from a 15-year data record (1979–1994) of the Microwave Sounding Unit. The MSU’s geophysical data sets are available in 1.0 or 2.5 degree latitude/longitude grids and contain either grid point anomalies, daily observations, 5-day averages, or monthly averages of the lower troposphere, upper troposphere, or lower stratosphere. Precipitation over the oceanic regions is also available. These data sets are continually processed and updated on a monthly basis. The MSU data have been processed for both the TOVS Pathfinder project and for studies of the global temperature variability.

SSM/T and SSM/T2 Data—Data from the Special Sensor Microwave/Temperature instrument and the second generation SSM/T2 aboard the F11 and future DMSP satellites (e.g., the F12 satellite) will be archived at the Marshall DAAC. These instruments provide information on the atmospheric temperature profile (SSM/T) and the vertical distribution of water vapor (SSM/T2) in the troposphere and stratosphere. NOAA/NESDIS is the responsible agency for data processing. The archival of the SSM/T and T2 data sets at MSFC is under negotiation.

SMMR Data—Under the auspices of the NASA/NOAA Pathfinder program, the Nimbus–7 SMMR brightness temperature data set is being reprocessed with a consistent calibration. This reprocessing effort is being performed at JPL, and the finished product will be archived at MSFC.

Surface Data—There are numerous surface-based observations that are part of the MSFC DAAC archives. A continental U.S. summary of lightning and rainfall is created every 15 minutes. These products are generated from separate data sources but may be used in lightning and precipitation studies. Other surface observations available from the DAAC include measurements of river stream flows in the U.S. and the Amazon River Basin. Further expansion and enhancements of these surface and field experiment data sets are expected in the 1994–1995 time period.

4.7 National Snow and Ice Data Center

The projected 1998 holdings of the SI DAAC are summarized in Table 4.7, with additional information in Table A–7 of Appendix A. Proposed additions to current data holdings are described briefly in the following paragraphs.

Data Type	Volume (GB)	Date Avail.	Remarks
SSM/I brightness temperature and products	100	Current, Ongoing	Gridded brightness temperature, sea-ice and snow parameters
Nimbus–7 SMMR	34	Current	Gridded sea-ice and brightness temperature (Gloersen, Pathfinder)
Nimbus–5 ESMR	3	Current	Brightness temperature and sea-ice concentration
Altimetry	39	Current, Ongoing	Over ice sheets
In situ data	2	Current, Ongoing	Collect, archive, and support snow and ice in situ data sets
AVHRR-based products	402	1994	Prototype products; Level-0 polar subsets
TOVS, polar subset	TBD	1994	Medium-resolution sounding data for polar regions
Digitized sea ice charts	102	1994	Charts from Arctic and Antarctic Res. Institute, Russia

SSM/I—The SI DAAC will continue to archive and support the digital data sets described in Section 3.7 and to generate SSM/I gridded brightness temperature and sea-ice and snow-cover geophysical products in polar stereographic and EASE-Grid formats.

AVHRR—Data sets to be added to the SI DAAC include polar subsets of experimental AVHRR-derived products, including ice-surface temperature, cloud cleared imagery, and synoptic-scale ice

motion fields. AVHRR Level-1B data being acquired from DAACs and ADC's will be compiled into a distinct Level-2 polar data set. The specifics of this activity are being determined in coordination with the Polar DAAC User Group (PoDAG).

DMSP—Beginning in 1994, DMSP data will be available through the National Geophysical Data Center (NGDC) Digital DMSP Archive, which is a joint project of NSIDC and NGDC to acquire, archive, and disseminate DMSP data from the U.S. Air Force. As part of this project, NSIDC will provide the cryospheric research community with data services for DMSP data.

Altimeter Data—Satellite altimetry data are available from NSIDC via an archive at GSFC (supervised by Dr. Jay Zwally). NSIDC has arranged computer access and user services for this archive. The feasibility of moving this archive from GSFC to NSIDC is under consideration.

TOVS—The SI DAAC will assemble (for snow- and ice-covered areas) Level-1 subsets and higher order geophysical products based on atmospheric sounder data from TOVS and possibly SSM/T2. Validation and algorithm comparison studies currently underway in the scientific community will help determine the utility of TOVS data over ice and snow. A combined AVHRR/TOVS data set for retrieving cloud parameters and radiative fluxes is also under development, with at least an experimental prototype available by 1995.

Other Data—NSIDC will ensure that ancillary data sets of importance to the snow and ice research community are accessible, either by archiving these data or by coordinating with the DAACs and other centers holding such data. These include meteorological and climate data, Arctic river runoff data, drifting buoy, digital topographic data, meteorological model analysis fields, and historical surface observations. As requested by users and subject to PoDAG approval, SI DAAC will collect and organize data from polar expeditions of short duration (ship, on-ice camps) and aircraft flights.

Data Set Rescue, Assembly, and Integration—NSIDC is coordinating data set rescue, assembly, and integration under the aegis of NOAA's Earth Science Data and Information Management program and the NSF-sponsored Arctic System Science (ARCSS) program for important land-ocean-atmosphere snow and ice data. The data sets assembled under these programs will at least have metadata entries in the NSIDC Cryospheric Information Management System and, where appropriate, the EOSDIS IMS.

4.8 Oak Ridge National Laboratory

The projected ORNL DAAC holdings as of July 1998 are summarized in Table 4.8, with additional information in Table A-8 of Appendix A. Proposed additions to current holdings are briefly described in the following paragraphs.

Data Type	Volume (GB)	Date Available	Remarks
FIFE	25	1994	Ground measurements and remotely sensed data from comprehensive study of radiation, moisture, and CO ₂ fluxes on Konza Prairie ecosystem in Kansas, USA, in 1987 and 1989, including gridded data sets from FIFE Follow-on project.
OTTER	15.15	1994	Ground measurements and remotely sensed data from comparative study of carbon, nitrogen, and water fluxes in coastal, western Cascades, and eastern Cascades forests of Oregon, USA, in 1988–1991.
CDIAC	.50	1994	Numerous data packages including atmospheric concentrations of methane and carbon dioxide; estimates of global, national, and regional CO ₂ emissions; long-term temperature records; historical data from ice cores; data for chloroflourocarbons and other trace gases; and other data sets and computer models held by the ORNL Carbon Dioxide Information Analysis Center.
BOREAS	TBD	1995–97	Ground measurements and remotely sensed data from integrated study of forest–atmosphere interactions from southern, northern, and auxiliary sites along a transect through the boreal ecosystem of central Canada.
Net Primary Productivity	TBD	1995–	Comprehensive data base of ground measurements of net primary productivity, terrestrial plant carbon storage, and associated measurements from around the globe.

Table 4.8 ORNL DAAC—Summary of Projected July 1998 Data Holdings

BOREAS—In 1995, the ORNL DAAC will begin receiving and archiving data developed by NASA's Boreal Ecosystem–Atmosphere Study (BOREAS). BOREAS was initiated in 1990 to investigate the interactions between the boreal forest biome and the atmosphere. Surface, airborne, and satellite-based observations are being used to develop techniques to measure biological and physical processes and conditions that govern the exchanges of energy, water, carbon, and trace gases between boreal forest ecosystems and the atmosphere, particularly those processes that may be sensitive to global change. Remote-sensing techniques, along with field measurements, are being used to develop and test models and algorithms to transfer the understanding of processes from the local to regional scale. The investigation is being conducted in the boreal forest of Canada and is scheduled for completion in 1997. A major field effort began in 1994. BOREAS data will be transferred to the DAAC from BOREAS staff as they complete data documentation, quality assurance, and within-project integration and verification.

FIFE—The DAAC will archive data developed by follow-on studies to the First ISLSCP Field Experiment (FIFE). These include gridded data sets derived from FIFE data and from regional data that will be used for modeling and scaling biogeochemical processes. It is anticipated that these data will be in the on-line data system as well as published in a FIFE Follow-on CD-ROM.

Additional Data Sets—Additional data sets from the ORNL Carbon Dioxide Information Analysis Center will be available through the ORNL DAAC on-line system. Representative data sets include those found in *Trends '93: A Compendium of Data on Global Change*, a source containing multiple

data packages in the areas of atmospheric carbon dioxide (CO₂), atmospheric methane, trace gases, CO₂ emissions, and temperature.

The ORNL DAAC User Working Group has endorsed an effort by the DAAC to develop a net primary productivity data base for ground-based measurements from around the globe. A pilot project addressing the feasibility of such a data base and what associated data should be included has been initiated. It is anticipated that a first version of this data base can be available in 1995, with enhancements to follow.

Finally, the ORNL DAAC is investigating the feasibility of archiving biogeochemical dynamics data generated by other agencies or institutions such as National Science Foundation (NSF) Long-Term Ecological Research (LTER) data, DOE National Environmental Research Park (NERP) data (e.g., ORNL Walker Branch Watershed), and U.S. Forest Service forest inventory, forest health monitoring, and watershed research data. This may involve physically bringing data into the active archive, or including metadata in the Information Management System (IMS) with pointers to the agency or institution holding the data.

4.9 Socioeconomic Data and Applications Center

The long term goal of SEDAC is to develop and provide new policy oriented products and services, making use of EOS science products in conjunction with socioeconomic data. Prior to the availability of EOS science products, SEDAC will use existing Earth science products available from Earth science DAACs (e.g., Pathfinder data sets) that are applicable to public policy problems. These initial products and services will be designated SEDAC Pathfinders. In pursuit of this goal, SEDAC will provide access to required socioeconomic data in the US and worldwide. Such access may be met by agreements with data providers, or by data archive and distribution from SEDAC. The categories of data that may be available from SEDAC in 1998 are summarized below.

Land Use and Land Cover—“Land cover” describes the land surface of the Earth in terms of physical attributes in generalized categories such as “pasture,” “cultivated land,” or “deciduous forest.” “Land use” provides information that describes the human and dynamic driving forces behind the observed pattern of land cover involving factors such as economics, property rights, and custom. It emphasizes human use of land and other terrestrial resources, especially where such use has led to degradation of economic productivity or other valued characteristics.

Industrial Metabolism—For purposes of global environmental change, the study of industrial metabolism endeavors to trace the mass flows for key industrial materials of environmental significance, including the waste emissions associated with them, and the use and transformation of energy in various forms. It also encompasses the technical forces that drive the evolution of industrial processes.

Agricultural Metabolism—This category encompasses data essential for studying the effects of agriculture and changing agricultural practices in global environmental change, including silviculture

and animal husbandry. It also addresses data needed to understand the potential interactions between a changing environment and agricultural production, food security, and other aspects of the global food system.

Population Dynamics—Demographic data needed for purposes of global change studies include not only the total population and its change over time, but also key demographic parameters such as fertility, mortality, migration, and age structure at national and subnational levels. Also of interest are other demographic variables such as housing, ethnicity, occupation, income, and access to services. These data are customarily recorded in various international statistical compendia drawn from national census or other national sources. In addition, household-level data are especially important for human dimensions studies because they provide insights into the underlying processes at work in human behavior in relationship to the environment (e.g., demographic and epidemiological transitions).

Economic Activity—USGCRP singled out economics as the only discipline-separate component of the program. The decision of SEDAC to include Economic Activity as one of its data categories is made in part to anticipate the needs of this newly identified element of USGCRP.

Human Attitude, Preference, and Behavior—Data sets for the application of human attitudes, preferences, and behavior come from disciplines such as anthropology, sociology, history, and psychology; such trends can be tracked, in real time, to some degree by survey techniques, which are among the principal tools of the social sciences.

Social and Political Structure and Institutions—Institutions and organizations, ranging from families to governments, influence policy formation and the way that society is organized. Of particular interest is the large body of data about the development and implementation of international, national, and subnational agreements concerning global environmental change.

Human and Environmental Health—This category includes data holdings on human health related to the environment, ranging from pollution data to epidemiology. Also of interest are data on the health of the environment itself as it may relate to human health.

5.0 Reference Documents

The scope of the SDP is limited to the topics listed in Section 1.2. The documents listed below may be consulted for a more complete understanding of the EOSDIS, the EOS Program, and related science programs. Some of the documents are in the process of being developed and/or published.

ESSO Documents—The Earth Science Support Office (ESSO) maintains a Document Resource Facility to disseminate timely and relevant information related to Mission to Planet Earth. A complete list of available documents can be obtained by contacting ESSO, 300 D Street, Washington, DC 20024 (202/479-0360). Specific documents that are likely to be of widest interest are listed below.

- *Earth System Science—A Closer View*—A 208-page report of the Earth System Sciences Committee, NASA Advisor Council; provides a summary of the Committee's recommendations and specifics of the implementation plan.
- *Mission to Planet Earth*—Gives a general overview of global change and the goals and plans of Mission to Planet Earth.
- *Our Changing Planet: The FY 1993 U.S. Global Change Research Program*—A 90-page overview by CEES; a supplement to the President's FY92 budget.
- *Our Changing Planet: The FY 1991 Research Plan/The U.S. Global Change Research Program*—A 252-page detailed plan produced by CEES that establishes the basic research goals for EOS. A key reference.
- *1993 EOS Reference Handbook (NP-202)*—Provides an overview of EOS and description of instruments and investigations.
- *TOPEX/Poseidon Science Investigation Plan*—A description of the planned investigations and the major elements of the mission.

Program/Project Documents—The following documents contain information on the program- and project-level activities to develop and implement EOSDIS.

- *Earth Science Data and Information System (ESDIS) Level 2 Requirements (Volumes 0-5)*, 423-10-01-0 through 423-10-01-5.
- *EOS Reference Handbook*, NP-202, 1993.
- *IEOS Data Exchange Principles (Draft NASA Memo)*—Establishes the basis on which the IEOS agencies will share the data from the IEOS among themselves and make such data available to other users.
- *V0 EOSDIS Project Plan* (ESDIS in preparation)—Provides the planning and management of the V0 EOSDIS development.
- *V0 Functional Requirements Document* (ESDIS draft, Dec. 1991)—Provides the functional requirements for the V0 EOSDIS system.
- *EOS Program Level-1 Requirements*, December 10, 1991.

- *Project Plan for the Earth Observing System*, March 1992 (draft).
- *Report to Congress on the Restructuring of the Earth Observing System* (submitted by NASA, March 9, 1992)—Presents the science objectives of EOS, the proposed new spacecraft configurations, their impact on the science objectives, and other programmatic considerations.
- *Global Change Data and Information System (GCDIS) Tri-Agency (NOAA, NASA, USGS) Implementation Plan* (draft, March 1992)—Presents the Tri-Agency GCDIS implementation planning.

Scientific/Support Documents—The following documents provide additional information on science issues and related support activities.

- *EOS Science and Mission Requirements Working Group Report* (NASA Technical Memorandum 86129, Vol I & Appendix, Aug. 84)—Presents the science rationale, recommended observational needs, the broad system configuration, and recommended implementation strategy to achieve the EOS mission goals.
- *Report of the EOS Data Panel* (NASA Technical Memorandum 87777, 1986)—Provides a rationale and recommendation for planning, implementing, and operating the EOSDIS that can evolve to meet the EOS needs in the 1990s as recommended by the EOS Science and Mission Requirements Working Group.
- *Initial Scientific Assessment of the EOSDIS* (second EOS Data Panel report, EOS-89-1)—EOSDIS Science Advisory Panel comments on the EOSDIS development progress based on the EOSDIS development progress of the EOSDIS Phase-B contractor. Preliminary Requirements Reviews and the System Architecture Reviews.
- *Climate Change, The IPCC Scientific Assessment* (Report of the Intergovernmental Panel on Climate Change, edited by J.T. Houghton, G.J. Jenkins, and J.J. Ephraums, Cambridge Univ. Press, 1990)—A report by the IPCC presenting the results of international climate change studies, and the strategies and priorities for future research on climate change issues. A key reference.
- *EOS Output Data Products and Input Requirements* (prepared by the Science Processing Support Office, NASA, Goddard Space Flight Center, 1994)—Contains information on data products required by and to be generated by both the EOS Instruments and Interdisciplinary Teams.
- *V0 EOS Science Plan* (in preparation)—Presents the EOS science program objectives and approach.
- *V0 EOSDIS DAAC User and Data Services Handbook* (JPL Publication D-10053, September 24, 1992)—Contains information on the objectives, data, and on-line services of the individual centers.
- *DAAC Science Support Plans*—DAAC-specific planning documents.

- *Atlas of Satellite Observations Related to Global Change* (R.L. Gurney, J.C. Foster, and C.L. Parkinson, Cambridge Univ. Press, 1993)—Mission to Planet Earth described in words and images by EOS scientists.

Appendix A Current and Projected Data Inventories

One objective of the SDP is to organize and publish information needed to make data management decisions. A variety of information useful for data management was accumulated regarding the data sets to be archived over the time period FY94–FY98. The upper time limit overlaps the scheduled launch of the EOS AM–1 platform. The tables in Appendix A are designed to show the evolution in DAAC contents and services from the V0 time frame into the EOS era.

Each data set is categorized in four areas: the source of the funding required to support the data set, the actions required to generate or handle the data set, the anticipated data demand (i.e., the type of user requiring the data), and the scientific priority for each data set. The priority is intended to indicate the scientific usefulness of the data. Priorities were determined by analyzing all available information, with final decisions made by the EOS Program Scientists. The data set priorities will be reassessed periodically by the Program Scientists in conjunction with the Users Working Groups (UWG's).

In addition to priorities, each data set has an indicated Level of Service for each year. Level of service indicates how scientists will use and access the data. There is often a direct correspondence between priority and service, but this is not always the case. As an example, the AVHRR Level-1B Pathfinder data set is one of the highest priority. However, since these data will be employed primarily in large-scale reprocessing by sophisticated users, only a low service level is needed. Data set priorities were determined by the EOS Program Scientists at NASA Headquarters. Level of service has been defined by the DAAC User Working Groups. Data set characterization information is included in the data set tables in this appendix.

ESDIS will use the priority, service level, and other information to resolve budgetary limitations that may prevent full funding support of the V0 EOSDIS activities. The DAAC managers are responsible for managing the funding and development activities required to support specific data sets at their respective DAACs, in accordance with the program and project level direction. Specific V0 DAAC science-data implementation plans will be developed between ESDIS and DAAC management each summer prior to the start of the fiscal year as part of the funding process for that DAAC.

While one V0 goal is for the DAACs to archive and support as much existing NASA Earth science data as possible, it probably will not be possible to support all of the existing data. This is due to financial constraints and technical difficulties such as media degradation or hardware problems. Affected data will be transferred to an inactive, permanent archive. Before any data action is undertaken, announcements of the impending actions will be made. In all cases, the appropriate UWG's, Program Scientists, and Project Scientists will be involved in data management decisions.

This appendix contains the current and projected data inventories at the V0 DAACs. This version contains 10 tables, one for each of the original seven DAACs plus ORNL and SEDAC. In addition, a supplemental table follows the listings for the GSFC DAAC, displaying the data sets originally held in the NCDS and PLDS data systems. These tables list data sets available as of July 1994, the V0 delivery date, and those anticipated through July 1998, in 1-year increments. This appendix will be updated at least annually, as justified by new information about DAAC holdings, data

volumes, levels of service, and funding. The revised tables will be displayed and available electronically.

Most tables are divided into three or more sections. The first section displays data sets available through the IMS at each DAAC in July 1994. The second section shows data sets for which funding for production, archiving, and distribution (P.A.D. funding) has been identified, but the data sets were not available through a DAAC IMS as of July 1994; some of these data sets will be developed from future missions, e.g., TRMM. The third section shows “candidate” data sets. These may be data sets actually stored at the DAACs (or data sets the DAACs would like to archive), but for which no funding exists to support permanent archiving of the particular data sets and inclusion in the DAAC IMS.

The tables summarize the current and anticipated holdings at the data set level. The descriptions of the data sets are provided by the DAACs. Additional information can be obtained from the NASA Global Change Master Directory and catalogs maintained by the individual centers.

More detailed information, on the parameter level, can be obtained from the DAAC User Support Offices and from the Science Processing Support Office (SPSO) at GSFC. SPSO documentation will contain all of the data set information contained in this appendix plus complementary information, e.g., descriptions of geophysical parameters.

Data sets listed in the tables have been characterized in terms of actions required to archive the data, who requires the data, and priority ranking. Several sources of information were combined to generate the indicated priorities. The primary source of information was supplied by the several DAAC User Working Groups (UWG’s). For several of the groups, this input was available only in the form of meeting notes. IPCC priorities and the information collected prior to and at the Seattle IWG meeting in August 1991 were also used in setting these priorities; they are shown in the tables in column **P**.

The Version 3.0 tables have been modified to more clearly identify data sets for which there are distribution restrictions. Restricted data sets are identified by **X** in the DR column. In addition, the product ID, platform, instrument or experiment, data set names, and comments entries are all in italics.

Explanations of the information included in each column of the tables are as follows:

Prod. ID—A number assigned to each data set as a convenient reference and to serve as a link between the facing pages for each table. The data product ID number will be retained in subsequent versions of the SDP.

Platform—Identifies the “thing” used as a base for data collection. This entry will often be the name of a satellite.

Instr./Exp.—Identifies the observing instrument that collected the data or, as an alternative, the scientific investigation in which the data were collected.

DR—Identifies those data sets with distribution restrictions. Restricted data sets are identified by **X**.

Data Set Name—A descriptive name of the data set.

Prod. Lvl—The level (or levels) of the data product(s) contained in the data set. Levels were assigned according to EOS definitions.

Data Producer—Identifies the individual or organization responsible for generating or processing the data set. The entry will be as appropriate for each data set and could be a flight project (UARS), a data processing center (GSFC, GISS), or an investigator (Wentz). A blank indicates that the data producer was not identified.

Archive Jul-94,...,Jul-98—Identifies the data center or archive that held the data as of Oct. 1, 1993, and that is expected to hold the data by the end of FY95. A blank indicates that the data are not in any archive in FY94.

Vol. (GB) Jul-94,...,Jul-98—Indicates the estimated archived data volume in Gigabytes in July 1994 and the anticipated total accumulated data volumes as of July of each year through 1998. Since the TRMM and EOS AM-1 missions are not scheduled for launch until August 1997 and June 1998, respectively, and since scheduled launch dates may be subject to slippage, the volume information for these missions is presented differently. The value in the Jul-98 column represents a normalized daily increment in Gigabytes, unless specifically indicated otherwise. The normalization is made so that products produced on a weekly or monthly basis can be compared to products archived on a daily basis. Volume information for ASTER, LIS, MISR, MODIS, and MOPITT is based on the July 22, 1994, SPSO product list and revisions to those values received by the SPSO from instrument team investigators after their review. CERES volume information includes CERES input to the EOS Ad Hoc Working Group (AHWGP). AHWGP studies of the other instruments are underway; any future revisions to volume information will be incorporated into future versions of the appendices which will be posted electronically. The meaning of A*, 0.0, TBD, and blank are:

A*	=	Analog data,
0.0	=	Data volume known or estimated, but less than 10 MB
TBD	=	Data volume not known or no July 1994 estimate available
blank	=	No entry in the data volume column indicates that the data set does not exist or it is not expected to be held at that DAAC in July 1994. This will be used to indicate data sets to be migrated; i.e., an entry in July 1994 column and a blank in July 1995 column identifies a data set to be moved.

Date Avail.—Indicates that the data are currently available, shown by C, or gives the estimated date of availability for both new and migrating data sets.

Service Lvl¹ Jul-94,...,Jul-98—Indicates the level of user service currently provided in July 1994, and the requirement for user support to be provided through July 1998. The code for the service level currently used is:

H. High (highest level of service),

¹In future versions of this Appendix, the code for service levels will be designated 1–5, 1 being the lowest (i.e., minimum level of services) and 5 being the highest. To date, only JPL and MSFC have provided this information.

This service level will have data available on-line or near-line; i.e., no operator activity is required to access the data set. Relatively complete metadata and browse support will be available.

M. Medium (moderate level of service)

Data will be stored off-line but will be quickly accessible. Metadata will be less complete, and browse support may not exist.

L. Low (lowest, minimum level of service)

Data will be stored off-line and may be in a remote location. Data access may take some time. Only limited metadata will be available, and browse products will generally not exist.

n No service provided.

or 1, 2, 3, 4, 5 as defined in the *ESDIS Project Level 2 Requirements —Volume 5*. (An approximate correlation between the H/M/L and numeric grades can be made as follows: 4, 5 = H; 2, 3 = M; 1 = L).

Data Category—The tables contain four columns that categorize data in terms of **Funding (F)**, **Action required (A)**, **source of data Demand (D)**, and **Priority (P)**.

F—Funding

- A. EOSDIS funded
- B. Pathfinder funded
- C. Other project (not EOS) funded
- D. No funding required (e.g., static data set)
- E. Funding required—source not identified.

A—Action Required

- A. Process or generate
- B. Recover from old media, reformat, etc.
- C. Data to be moved to another DAAC
- D. Archive
- E. Research area, DAAC activities TBD.

D—Source of Data Demand (i.e., data required by)

- A. Instrument PI
- B. Interdisciplinary Investigators
- C. Other EOS users
- D. General users.

P—Priorities

- H. High—essential data

- M. Moderate—needed data
- L. Low—be nice to have data
- n. No interest—no use for data.

Coverage Temporal, Spatial—Temporal Coverage indicates when the data were collected or the time span over which the data set was generated. Spatial Coverage indicates the region covered by the data set, which could be an area on the surface of Earth or an altitude range.

Res.—This column will contain any appropriate information on the spatial or temporal resolution of the data.

Comments—This field is used to present any appropriate additional information on the data set.

Appendix B Acronym List

AAOE	Airborne Antarctic Ozone Experiment
ABLE	Arctic Boundary Layer Expedition
ACR	Active Cavity Radiometer
ACRIM	Active Cavity Radiometer Irradiance Monitor
ACS	Archive and Catalogue System
ADC	Affiliated Data Center
ADEOS	Advanced Earth Observing System
AEM	Application Explorer Mission
AES	Atmospheric Emission Spectrometer
AHAP	NASA High Altitude Aerial Photography
AIDJEX	Arctic Ice Dynamics Joint Experiment
AIRSAR	Aircraft Synthetic Aperture Radar
ALRSS	Advanced Land Remote Sensing System
ALT	Altimeter
AMPR	Advanced Microwave Precipitation Radar
AMSU	Advanced Microwave Sounding Unit
ARC	Ames Research Center
ASAS	Advanced Solid State Array Sensor
ASF	Alaska SAR Facility
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
ATLAS	Atmospheric Laboratory for Applications and Science
ATMOS	Atmospheric Trace Molecules Observing Spectrometer
ATSDR	Agency for Toxic Substances and Disease Registry
AVHRR	Advanced Very High-Resolution Radiometer
AVIRIS	Airborne Visible Infrared Imaging Spectrometer
BEA	Bureau of Economic Analysis
BOREAS	Boreal Ecosystem–Atmosphere Study
BRDF	Bidirectional Reflectance Distribution Function
CAC	Climate Analysis Center (NOAA/MNC)
CCSD	Computer Compatible Signal Data
CCT	Computer Compatible Tapes
CD-ROM	Compact Disk - Read Only Memory
CDF	Common Data Format
CDHF	Central Data Handling Facility
CDIAC	Carbon Dioxide Information and Analysis Center
CDMS	Climate Data Management System
CEAREX	Coordinated Eastern Arctic Experiment
CERES	Clouds and Earth's Radiant Energy System
CIA	Central Intelligence Agency
CIESIN	Consortium for International Earth Science Information Network
CLAES	Cryogenic Limb Array Etalon Spectrometer
CMP	Computer Model Package
CNES	Centre National d'Etudes Spatiales (France)
COADS	Comprehensive Ocean Atmosphere Data Set
CSA	Canadian Space Agency
CY	calendar year
CZCS	Coastal Zone Color Scanner
DAAC	Distributed Active Archive Center
DADS	Data Archive and Distribution System
DAO	Data Assimilation Office

DEM	Digital Elevation Model
DLG	Digital Line Graph
DMA	Defense Mapping Agency
DMSP	Defense Meteorological Satellite Program
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
DTED	Digital Terrain Elevation Data
EASE-Grid	Equal Area SSM/I Earth Grid
EDC	Eros Data Center
EO-ICWG	Earth Observation-International Coordination Working Group
EOS	Earth Observing System
EOSAT	Earth Observing Satellite Corporation
EOSDIS	EOS Data and Information System
EOSP	Earth Observing Scanning Polarimeter
EPA	Environment Protection Agency
ERB	Earth Radiation Budget
ERBE	Earth Radiation Budget Experiment
ERBS	Earth Radiation Budget Satellite
EROS	Earth Resources Observation System
ERS	Earth Resources Satellite
ERTS	Earth Resource Technology Satellite
ESA	European Space Agency
ESDIS	Earth Science Data Information System (Project)
ESMR	Electronically Scanning Microwave Radiometer
ESSO	Earth Science Support Office
ETM	Enhanced Thematic Mapper
ETM+	Enhanced Thematic Mapper Plus
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
FIFE	First ISLSCP Field Experiment
FIRE	First ISSCP Regional Experiment
FNOC	Fleet Numerical Oceanographic Center
FOLD	Federally Owned Landsat Data
FRC	Federal Record Center
FTP	File Transfer Protocol
FY	Fiscal year
GAC	Global Area Coverage
GARP	Global Atmosphere Research Programme
GB	GigaByte (10E9)
GCDIS	Global Change Data and Information Center
GCMD	Global Change Master Directory
GCRP	Global Change Research Program
GDC	GeoData Center (Univ. of Alaska, Fairbanks)
GDR	Geophysical Data Record
GEOS	Geodetic Earth Observation Satellite
Geosat	Navy Geodetic Satellite
GEWEX	Global Energy and Water Cycle Experiment
GISS	Goddard Institute for Space Studies
GLA	Goddard Laboratory for Atmospheres
GLIS	Global Land Information System
GMS	Geostationary Meteorological Satellite
GOES	Geostationary Operational Environmental Satellite

GPS	Global Positioning System
GRILLE	Grille Spectrometer
GSFC	Goddard Space Flight Center
GTE	Global Tropospheric Experiment
HALOE	Halogen Occultation Experiment
HazDat	Hazardous Substance Release/Health Effects Database
HDDT	High Density Digital Tapes
HDF	Hierarchical Data Format
HRDI	High Resolution Doppler Interferometer
HRMSI	High Resolution Multispectral Stereo Imager
HRPT	High Resolution Picture Transmission (AVHRR)
ICWG	International Coordination Working Group
IEOS	International Earth Observing System
IFO	Intensive Field Observation
IGDR	Intermediate Geophysical Data Record
IMS	Information Management System
IPCC	Intergovernmental Panel on Climate Change
IR	Infrared
ISAMS	Improved Stratospheric and Mesospheric Sounder
ISCCP	International Satellite Cloud Climatology Project
ISLSCP	International Satellite Land Surface Climatology Project
JEA	Japan Environmental Agency
JERS	Japanese Earth Remote-sensing Satellite
JPL	Jet Propulsion Laboratory
km	kilometer
LAC	Local Area Coverage
LaRC	Langley Research Center
LFC	Large Format Camera
LIMS	Local Information Manager
LIS	Lightning Imaging Sensor
LMD/ARA	Laboratoire de Meteorologie Dynamique/Atmospheric Radiation Analysis Group
LPM	Landsat Program Management
LTER	Long-Term Ecological Research
MAPS	Measurement of Atmospheric Pollution from Satellites
MAS	Millimeter-wave Atmospheric Sounder
MB	MegaByte (10E6)
McIDAS	Man-computer Interactive Data Access System
MCSST	Multi-Channel Sea Surface Temperature
MIMR	Multifrequency Imaging Microwave Radiometer
MITI	Ministry of International Trade and Industry (Japan)
MIZEX	Marginal Ice Zone Experiment
MLS	Microwave Limb Sounder
MMAS	Martin Marietta Astro Space
MODIS	Moderate Resolution Imaging Spectrometer
MOPITT	Measurement of Pollution in the Troposphere
MOU	Memorandum of Understanding
MSFC	Marshall Space Flight Center
MSS	Multispectral Scanner System

MSU	Microwave Sounding Unit
N/A	Not Applicable
NARA	National Archives and Record Administration
NASA	National Aeronautics and Space Administration
NASDA	National Space Development Agency of Japan
NCAR	National Center for Atmospheric Research
NCDC	National Climate Data Center
NCDS	NASA Climate Data System
NDP	Numerical Data Package
NDVI	Normalized Difference Vegetation Index
NERP	National Environmental Research Park
NESDIS	National Environmental Satellite Data and Information Service
NGDC	National Geophysical Data Center
NMC	National Meteorological Center
NOAA	National Oceanographic and Atmospheric Administration
NODS	NASA Ocean Data System
NSCAT	NASA Scatterometer
NSIDC	National Snow and Ice Data Center
NSSDC	National Space Science Data Center
NURE	National Uranium Resource Evaluation
OCI	Ocean Color Imager
OLS	Operational Line Scan
ONC	Operational Navigational Charts
ONR	Office of Naval Research
OPT	Ozone Processing Team
ORNL	Oak Ridge National Laboratory
OSC	Orbital Sciences Corporation
OTD	Optical Transient Detector
OTTER	Oregon Transect Ecosystem Research
P.A.D.	Production, Archiving, and Distribution
PBL	Planetary Boundary Layer
PEM	Particle Environment Monitor
PGS	Product Generation System
PLDS	Pilot Land Data System
POE	Precision Orbit and Ephemeris
PR	Precipitation Radar
PSC	Polar Science Center
PUMS	Public Use Microdata Samples
QA	Quality Assurance
RSS	Remote Sensing Systems
RUF	Raw Units File
RUT-T	Raw Units Tape-TOMS
SAA	Satellite Active Archive
SAGE	Stratospheric Aerosol and Gas Experiment
SAM	Stratospheric Aerosol Measurement
SAR	Synthetic Aperture Radar
SBUV	Solar Backscatter Ultraviolet Radiometer
SDP	Science Data Plan
SDR	Sensor Data Record
SDPS	Science Data Production System

SDSD	Satellite Data Services Division
SeaWiFS	Sea-Viewing Wide Field of View Sensor
SEDAC	Socioeconomic Data and Applications Center
S-GCOS	Space-Based Global Change Observation System
SIC	Standard Industrial Classification
SIR	Shuttle Imaging Radar
SLAR	Side Looking Airborne Radar
SME	Solar Mesosphere Explorer
SMMR	Scanning Multichannel Microwave Radiometer
SMS	Synchronous Meteorological Satellite
SOLCON	Solar Constant Radiometer
SOLSPEC	Solar Spectrum Radiometer
SOLSTICE	Solar/Stellar Irradiance Inter-Comparison Experiment
SPDB	Science Processing Data Base
SPOT	System pour l'Observation de la Terre (France)
SPSO	Science Processing Support Office
SRB	Surface Radiation Budget
SSBUV	Shuttle Solar Backscatter Ultraviolet
SSEC	Space Science and Engineering Center
SSM/I	Special Sensor Microwave/Imager
SSM/T	Special Sensor Microwave/Temperature
SST	Sea Surface Temperature
STA	Japanese Science and Technology Agency
SUSIM	Solar Ultraviolet Spectral Irradiance Monitor
SWG	Science Working Group
TB	TeraByte (10E12)
TBD	to be determined
TES	Tropospheric Emission Spectrometer
TIMS	Thermal Infrared Multispectral Scanner
TIROS	Television Infrared Observational Satellite
TM	Thematic Mapper
TMI	TRMM Microwave Imager
TMR	TOPEX/Poseidon Microwave Radiometer
TMS	Thematic Mapper Simulator
TOGA-COARE	Tropical Ocean and Global Atmosphere-Coupled Ocean Atmosphere Response Experiment
TOMS	Total Ozone Mapping Spectrometer
TOPEX	Ocean Topography Experiment
TOVS	TIROS Operational Vertical Sounder
TRMM	Tropical Rainfall Measuring Mission
TSDIS	TRMM Science and Data Information System
UARS	Upper Atmosphere Research Satellite
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
USGCRP	US Global Change Research Program
USGS	United States Geological Survey
UWG	Users Working Group
V0	Version 0
VIRR	Visible and Infrared Radiometer
VIRS	Visible and Infrared Spectrometer
VIS	Visible Imaging Spectrometer
WBVT	Wide Band Video Tape

WFF	Wallops Flight Facility
WINDII	Wind Imaging Interferometer
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment
WORM	Write Once Read Many